

EXHIBIT VOLUME—VIII
TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1961

No. 304

**CONTINENTAL ORE COMPANY, ET AL.,
PETITIONERS,**

vs.

**UNION CARBIDE AND CARBON
CORPORATION, ET AL.**

**ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT**

PETITION FOR CERTIORARI FILED AUGUST 11, 1961
CERTIORARI GRANTED OCTOBER 23, 1961

SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1961

No. 304

CONTINENTAL ORE COMPANY, ET AL.,
PETITIONERS,

vs.

UNION CARBIDE AND CARBON
CORPORATION, ET AL.

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

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[fol. 1]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT NO. 1

Plaintiff's Exhibit No. 1

INTERROGATORY NO. 7(d)

UNITED STATES VANADIUM CORPORATION
PRODUCTION OF FUSED VANADIUM OXIDE
FOR THE PERIOD JANUARY 1, 1933 TO DECEMBER 31, 1947
QUANTITIES SHOWN ARE POUNDS OF V₂O₅

CONTAINED

	<u>Uravan</u>	<u>Rifle</u>	<u>Bureau</u>	<u>Total</u>
1933	-	-	-	-
1934	-	-	-	-
1935	-	-	-	-
1936	33,446	-	-	33,446
1937	1,214,063	-	-	1,214,063
1938	1,875,096	-	-	1,875,096
1939	2,004,993	-	-	2,004,993
1940	2,175,823	-	-	2,175,823
1941	2,376,701	-	-	2,376,701
1942	2,174,433	1,038,073	-	3,212,506
1943	1,734,230	1,325,066	-	3,059,296
1944	722,293	1,357,009	170,125	2,249,427
1945	-	1,550,280	354,850	1,905,130
1946	-	1,321,923	-	1,321,923
1947	-	2,226,041	-	2,226,041

[fol. 1a]

*

		3	3	4	4	6
1	2	1	4	0	6	3
1	8	7	5	6	9	6
2	0	0	4	9	9	8
2	1	7	5	8	2	8
2	3	7	6	7	0	1
3	2	7	2	5	1	1
3	0	5	5	8	9	6
2	2	5	7	4	9	7
1	9	4	1	1	3	2
1	3	8	1	8	3	8
2	2	8	6	0	4	1

2 3,8 7 5,0 4 7 *

1a

[fol. 2]

EXHIBIT III**QUANTITATIVE YEARLY TOTAL OF VANADIUM PENTOXIDE
PRODUCED - 1933 - 1947**

<u>Year</u>	<u>Lbs. V₂O₅</u>
1933	83,525
1934	377,374
1935	None
1936	420,318
1937	1,035,337
1938	1,354,891
1939	2,400,547
1940	2,379,372
1941	2,421,959
1942	3,097,962
1943	2,958,368
1944	1,992,783
1945	1,811,161
1946	809,960
1947	2,717,134

[fol. 2a]

*

	8	3	5	2	5
	3	7	7	3	4
	4	2	0	3	1
1	0	2	5	3	3
1	3	5	4	8	9
2	4	0	0	5	4
2	3	7	5	3	7
2	4	2	1	9	5
3	0	9	7	9	6
2	9	5	8	3	6
1	9	5	2	7	3
1	8	1	1	1	3
	8	0	5	9	6
2	7	1	7	1	3

2 2.8 0 0.7 1 1 *

2a

[fol. 3]

INTERROGATORY NO. 8(c)UNION CARBIDE AND CARBON CORPORATION AND SUBSIDIARIES CONSOLIDATED

STATEMENT SHOWING QUANTITY OF VANADIUM OXIDE AND AMMONIUM
 METAVANADATE SOLD DURING THE PERIOD JANUARY 1, 1933 TO AND
 INCLUDING DECEMBER 31, 1947

<u>VANADIUM OXIDE</u> <u>(Lb. Contained V_2O_5)</u>	<u>YEAR</u>	<u>AMMONIUM METAVANADATE</u> <u>(Lb. of Material)</u>
217,333.67	1933	2,591
786,785.30	1934	1,080
973,654.40	1935	2,000
377,063.51	1936	1,402
883,397.75	1937	2,431
1,255,222.11	1938	360
1,139,109.70	1939	180
743,673.95	1940	233
369,534.74	1941	321
341,236.00	1942	1/4
247,753.34	1943	43
151,854.65	1944	2,100
313,856.29	1945	2,401
835,962.96	1946	7,827
2,133,647.97	1947	43,294 1/2

Sales of sand tailings to the Manhattan District in
 the years 1943 and 1944 are not reflected in the
 figures above. 3

[fol. 4]

EXHIBIT VI

**QUANTITATIVE YEARLY TOTAL OF ALL VANADIUM COMPOUNDS
OTHER THAN FERROVANADIUM AND VANADIUM PENTOXIDE
(1) PRODUCED AND (2) SOLD FROM JANUARY 1, 1933
THROUGH DECEMBER 31, 1947**

<u>Year</u>	<u>Lbs. Produced</u>	<u>Lbs. Sold</u>
1933	1,256	1,112
1934	877	1,523
1935	2,159	1,964
1936	3,153	2,496
1937	7,427	6,878
1938	3,566	1,693
1939	32,688	26,769
1940	39,785	31,193
1941	236,346	194,386
1942	908,912	814,189
1943	142,067	131,663
1944	221,934	228,096
1945	189,694	120,739
1946	25,533	39,256
1947	21,458	— 48,573

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IN UNITED STATES DISTRICT COURT

New York, N. Y., May 9, 1950

ANNUAL FERROVANADIUM PRODUCTION
(1911-1949, inclusive)
Pounds of Vanadium

		High Speed	Open Hearth	Special	Total
1933	Niagara	10,297	-	-	10,297
	Columbiana	-	170,519	-	170,519
	Total	10,297	170,519	-	180,816
1934	Niagara	-	-	-	-
	Columbiana	-	143,081	65,107	228,188
	Total	-	143,081	65,107	228,188
1935	Niagara	-	-	-	-
	Columbiana	17,945	134,850	29,144	181,939
	Total	17,945	134,850	29,144	181,939
1936	Niagara	-	1,287 ^a	-	1,287 ^a
	Columbiana	45,455	58,781	13,528	117,764
	Total	45,455	59,068	13,528	117,764
1937	Niagara	-	-	-	-
	Columbiana	72,397	115,649	113,171	301,217
	Total	72,397	115,649	113,171	301,217
1938	Niagara	-	-	-	-
	Columbiana	43,118	157,785	44,216	245,079
	Total	43,118	157,785	44,216	245,079

^aConversion - Customer's Material.

R-Palda/mj

		High Speed	Open Hearth	Special	Total
1939	Niagara	-	4,934	21,123	26,057
	Columbiana	29,094	133,600	102,658	265,352
	Total	29,094	138,534	123,781	291,409
1940	Niagara	30,310	65,518	-	95,828
	Columbiana	70,322	23,240	183,998	347,660
	Total	100,632	159,058	183,998	443,688
1941	Niagara	3,440	203,638	-	207,078
	Columbiana	135,818	238,765	438,636	813,219
	Alloy	-	302,876	-	302,876
	Total	139,258	745,279	438,636	1,323,173
1942	Niagara	14,854	75,806	20,107	110,767
	Columbiana	17,202	455,987	345,157	818,346
	Alloy	-	-	610,426	610,426
	Total	32,056	531,793	975,690	1,539,539
1943	Niagara	-	-	4,461	4,461
	Columbiana	-	244,011	595,392	839,403
	Alloy	184,914	900,039	-	1,084,953
	Total	184,914	1,144,050	599,853	1,928,817
1944	Niagara	-	-	-	-
	Columbiana	123,890	175,480	367,853	667,223
	Alloy	104,501	208,033	-	312,534
	Total	228,391	383,513	367,853	979,757

[fol. 5]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 2

EXHIBIT IV**QUANTITATIVE YEARLY TOTAL OF FERROVANADIUM
PRODUCED - 1933 - 1947**

<u>Year</u>	<u>Lbs. "V"</u>
1933	184,692
1934	673,434
1935	612,943
1936	632,106
1937	1,039,999
1938	482,259
1939	788,622
1940	1,569,473
1941	2,360,386
1942	2,559,585
1943	2,834,751
1944	2,020,644
1945	1,457,220
1946	741,113
1947	667,224

[fol. 6a]

	1	8	4	6	9	2
	6	7	3	4	3	4
	6	1	2	9	4	3
	6	2	2	1	0	6
1	0	2	5	9	9	9
	4	8	8	2	5	9
	7	8	8	6	3	2
1	5	6	5	4	7	3
2	3	6	0	3	8	6
2	5	5	5	5	8	5
2	8	2	4	9	5	1
2	0	2	0	6	4	4
1	4	5	7	7	2	0
	7	4	1	1	1	3
	6	6	7	2	2	4

O 1 0.6 2 0.7 1.1 *

6a

[fol. 7]

32. That during the period 1933 through 1944 the total production of ferrovanadium by Electro Metallurgical Co. was approximately 7,834,731 pounds contained vanadium.

ANSWER: Said defendants hereby revise their answer to Interrogatory 8(e) propounded by plaintiffs and on file herein and admit that Union Carbide and Carbon Corporation and its United States subsidiaries, consolidated produced the following quantities of ferrovanadium in the years indicated:

<u>Year</u>	<u>Pounds of Contained "V"</u>
1933	180,816
1934	228,128
1935	181,319
1936	193,073
1937	301,217
1938	245,079
1939	292,347
1940	443,688
1941	1,323,641
1942	1,540,524
1943	1,835,628
1944	1,066,508
1945	708,649
1946	458,855
1947	<u>406,701</u>
Total	<u>9,406,173</u>

Said revision is occasioned by clerical errors or different accounting methods used in prior computations.

[fol. 8]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 3

IN UNITED STATES DISTRICT COURT

✓ Plaintiffs' Exhibit No. 3

6c

VANADIUM CORPORATION OF AMERICATOTAL DOMESTIC SALES

(Exclusive of Sales to U. S. Government)

FERRO VANADIUM AND VANADIUM PENTOXIDEYEARS 1933 - 1944 INCLUSIVE

	<u>Ferro Vanadium</u> (In Pounds etd v)	<u>Vanadium Pentoxide</u> (In Pounds etd V_2O_5)
1933	363,947.64	23,028.54
1934	466,626.80	18,205.55
1935	477,592.60	93,669.18
1936	703,386.39	20,711.15
1937	827,527.92	126,349.30
1938	282,286.73	989,235.71
1939	796,796.76	1,676,000.24
1940	1,377,131.35	281,172.10
1941	2,588,141.51	358,165.52
1942	2,468,051.80	537,155.21
1943	2,084,792.83	111,153.46
1944	1,970,858.30	192,281.56

8

TOTAL TONNAGE OF ALL VARIETIES OF VANADIUM SOLD IN UNITED STATES
1933 - 1944

	<u>FERROVANADIUM</u> <u>(Lb. Contained V)</u>	<u>VANADIUM OXIDE</u> <u>(Lb. Contained V₂O₅)</u>	<u>AMMONIUM METAVANADATE</u> <u>(Lb. of Material)</u>
1933	272,229	217,334	2,991
1934	215,508	800,183	1,150
1935	215,319	521,112	2,000
1936	231,704	378,128	1,412
1937	291,945	588,670	2,470
1938	125,745	172,733	960
1939	270,577	174,665	2,144
1940	440,494	163,904	233
1941	1,333,440	235,917	2,796
1942	1,312,512	309,763	4
1943	1,547,440	203,310	23
1944	932,486	148,327	2,200

PHD:cm
5/15/50

ver

EXHIBIT V

QUANTITATIVE YEARLY TOTALS OF THE PERUVIAN SALT IN THE DOMESTIC AND CANADIAN MARKETS, EXCLUSIVE OF SALES TO THE UNITED STATES GOVERNMENT, 1931-1947, AND AS TO EACH YEAR, THE LIST PRICE CHARGED THEREON

Year	Spot Month Grade			Crucible Grade			Prime Grade		
	List Prices			List Prices			List Prices		
	lbs. old V	per lb. old V	Contract Basis	lbs. old V	per lb. old V	Contract Basis	lbs. old V	per lb. old V	Contract Basis
1933	579,438	2.60	2.60	83,994	2.70	2.70	752	2.80	2.80
1934	382,361	2.70	2.70	182,902	2.80	2.80	1,362	2.90	2.90
1935	377,689	2.70	2.70	199,364	2.80	2.80	538	2.90	2.90
1936	417,686	2.70	2.70	280,989	2.80	2.80	4,930	2.90	2.90
1937	453,782	2.70	2.70	379,790	2.80	2.80	11,054	2.90	2.90
1938	320,876	2.70	2.80	48,533	2.80	2.90	2,876	2.90	3.00
1939	563,861	2.70	2.80	246,043	2.80	2.90	7,892	2.90	3.00
1940	905,838	2.70	2.80	453,225	2.80	2.90	18,667	2.90	3.00
1941	1,623,897	2.70	2.80	932,661	2.80	2.90	31,582	2.90	3.00
1942	1,380,119	2.70	2.80	1,164,190	2.80	2.90	43,741	2.90	3.00
1943	1,306,034	2.70	2.80	728,510	2.80	2.90	52,247	2.90	3.00
1944	1,193,770	2.70	2.80	693,234	2.80	2.90	84,231	2.90	3.00
1945	742,133	2.70	2.80	639,478	2.80	2.90	12,691	2.90	3.00
1946	413,517	2.70	2.80	357,609	2.80	2.90	1,694	2.90	3.00
1947	422,952	2.70	2.80 (1)	375,586	2.80	2.90 (2)	3,707	2.90	3.00(3)

(1) Contract price advanced to \$2.90 and spot price to \$3.00 on or about October 1, 1947.

(2) Contract price advanced to \$3.00 and spot price to \$3.10 on or about October 1, 1947.

(3) Contract price advanced to \$3.10 and spot price to \$3.20 on or about October 1, 1947.

[fol. 10]

VANADIUM CORPORATION OF AMERICA
INVENTORY AND SALES VANADIUM PRODUCTS
YEARS 1933 TO 1944 INCLUSIVE

Year	<u>Ferro Vanadium</u> <u>Lbs. "V" Contained</u>		<u>Vanadium Pentoxide</u> <u>Lbs. "V2O5" Contained</u>	
	<u>Inventory</u> <u>12/31</u>	<u>Sales</u> <u>for Year</u>	<u>Inventory</u> <u>12/31</u>	<u>Sales</u> <u>for Year</u>
1933	96,162.97	458.02	99,908.38	23,028.54
1934	226,044.52	543,552.21	149,567.57	18,205.55
1935	382,043.92	481,041.82	97,067.12	189,790.89
1936	256,373.42	759,073.11	93,599.53	107,061.55
1937	237,391.89	1,058,999.39	127,737.94	126,353.53
1938	304,192.88	421,457.98	69,948.01	989,239.93
1939	239,472.73	851,581.98	185,997.29	1,959,653.02
1940	321,570.99	1,491,119.30	451,196.82	632,661.67
1941	117,206.74	2,598,867.65	93,368.18	358,165.52
1942	126,346.04	2,566,130.78	83,533.32	537,176.37
1943	194,073.90	2,761,995.02	186,050.29	111,247.41
1944	77,778.29	2,254,130.59	101,134.58	192,281.84

[fol. 12]

A. E. MORRISON (1891-1971)
 HERBERT W. CLARK
 ROBERT C. FOERSTER
 J. P. SHUMAN
 LEON F. DE FREYER
 FORREST A. COBB
 WILLIAM L. HOLLOWAY
 W. T. FITZGERALD
 J. HART CLINTON
 FRANCIS C. HUTCHENS
 C. COG. IDGE KNER
 BOICE CROSS
 JOHN W. MC CRISTLE
 ALFRED L. GIBSON
 GEORGE F. CLINTON
 JAMES BARTON PHELPS
 CLARENCE E. RUETO
 JOHN PAUL JUSTIN
 JAMES J. DUMMETT
 JOHN L. RECHER, JR.
 ROBERT HOWARD
 RICHARD J. ARCHER

LAW OFFICES OF
 MORRISON, HOFELD, FOERSTER, SHUMAN & CLARK

CROCKER BUILDING

SAN FRANCISCO 4

TELEPHONE GARFIELD 1-5670

CLARK HOFELD
 CLARENCE

November 15, 1950

Joseph L. Alioto, Esq.
 111 Sutter Street
 San Francisco 4, California

Re: Continental Ore Company et al. v. Union
Carbide and Carbon Corporation et al.

Dear Mr. Alioto:

Enclosed herewith is a statement of returned or cancelled sales of ferrovanadium in the United States for the years 1935 through 1944. In the statement previously delivered to you on June 2, 1950, showing ferrovanadium sales in the United States adjustment is not made for these returned or cancelled sales.

Very truly yours,

Herbert W. Clark

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HWC:RJA:ap

Enclosure

RETURNED OR CANCELLED SALES OF FERROVANADIUM IN UNITED STATES
1935 - 1944

1935	300	lbs.
1936	300	"
1937	5,300	"
1938	540	"
1942	600	"
1943	85,524	"
1944	5,000	"

[fol. 14]

INTERROGATORY NO. 8(f)

UNION CARBIDE AND CARBON CORPORATION
AND SUBSIDIARIES CONSOLIDATEDSTATEMENT SHOWING QUANTITY OF FERROVANADIUM
(BY GRADES) SOLD, AND AVERAGE UNIT SALES PRICES
PERIOD JANUARY 1, 1933 TO AND INCLUDING
DECEMBER 1, 1947

Year	FERROVANADIUM HIGH SPEED		FERROVANADIUM SPECIAL		FERROVANADIUM OPEN HEARTH	
	Lbs. V Sold	Average Unit Sales Price Per Lb. V	Lbs. V Sold	Average Unit Sales Price Per Lb. V	Lbs. V Sold	Average Unit Sales Price Per Lb. V
1933	1,627.54	\$ 2.867	61,987.84	\$ 2.671	222,076.91	\$ 2.627
1934	3,259.83	\$ 2.890	51,058.58	\$ 2.800	172,730.03	\$ 2.703
1935	6,244.51	\$ 2.894	68,278.95	\$ 2.799	148,874.66	\$ 2.699
1936	15,536.65	\$ 2.902	87,106.73	\$ 2.798	141,139.29	\$ 2.701
1937	34,446.20	\$ 2.889	134,726.42	\$ 2.850	146,382.26	\$ 2.705
1938	14,648.43	\$ 2.923	38,412.44	\$ 2.929	83,367.89	\$ 2.703
1939	47,291.87	\$ 3.141	152,782.84	\$ 3.004	168,281.39	\$ 2.701
1940	57,190.75	\$ 3.198	211,328.83	\$ 2.893	249,094.94	\$ 2.700
1941	127,305.35	\$ 2.980	514,607.52	\$ 2.807	816,641.76	\$ 2.718
1942	89,563.08	\$ 2.945	662,752.39	\$ 2.800	663,995.92	\$ 2.729
1943	188,885.309	\$ 2.927	623,235.89	\$ 2.808	946,676.82	\$ 2.731
1944	283,427.315	\$ 2.904	325,446.46	\$ 2.825	532,874.448	\$ 2.720
1945	21,418.91	\$ 3.029	292,274.64	\$ 2.816	338,915.49	\$ 2.742
1946	45,607.19	\$ 3.009	269,425.90	\$ 2.800	177,691.53	\$ 2.723
1947	36,427.041	\$ 2.997	188,207.84	\$ 2.812	268,916.70	\$ 2.763

The sale prices received by Electro Metallurgical Company of Canada Ltd., for ferrovanadium sold in Canada are included in arriving at the average unit sales prices shown above.

[fol. 15]

INTERROGATORY NO. 8(i)

Part of Interrogatory

STATEMENT SHOWING AVERAGE UNIT SALES PRICES IN CANADA FOR FERROVANADIUM (BY GRADES) SOLD DURING THE PERIOD JANUARY 1, 1933 TO AND INCLUDING JULY 15, 1949

Year	FERROVANADIUM HIGH SPEED	FERROVANADIUM SPECIAL	FERROVANADIUM OPEN HEARTH
	Average Unit Sales Price Per Lb. V	Average Unit Sales Price Per Lb. V	Average Unit Sales Price Per Lb. V
1933	Can \$ 3.299	Can \$ 3.150	Can \$ 3.049
1934	3.300	2.800	2.736
1935	—	2.799	2.669
1936	—	—	2.700
1937	—	—	2.700
1938	2.912	—	2.702
1939	2.904	—	2.700
1940	2.902	3.100	2.700
1941	3.102	3.150	2.923
1942	3.149	—	2.950
1943	3.136	3.110	2.989
1944	3.419	3.110	3.000
1945	3.220	3.110	3.000
1946	3.195	—	2.910
1947	2.995	—	2.829
1948	3.280	—	3.071
1949 (Partial Year January 1 to and Including July 15)	3.280	—	3.071

[fol. 16]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 4

*Plaintiffs' Exhibit No. 4*ELECTRO METALLURGICAL SALES CORPORATIONTYPED PRICE SHEETSAMMONIUM META VANADATE

Dated - 12/5/28 - \$2.50 per running pound, delivered

6/8/32 - \$2.00 per pound, delivered. Freight surcharge
for account of Buyer.

12/19/32- \$1.90 per pound, delivered.

1/1/35 - Lots of 5,000# and over - \$1.90 per lb.
Lots under 5,000# - 2.00 " "Both prices are quoted f.o.b. our Works or
warehouses with freight charges allowed to
points within a reasonable distance.FERROVANADIUM2/1/28 - Open Hearth Grade: \$3.15
Special Grade: 3.40
High Speed Grade: 3.55All prices per pound contained vanadium,
f.o.b. our Works with freight charges allowed
to reasonable distance.12/5/28 - Open Hearth Grade: \$3.15
Special Grade: 3.25
High Speed Grade: 3.40All prices per pound of contained vanadium,
f.o.b. our Works with freight charges allowed
to reasonable distance.12/7/31 - Open Hearth Grade: \$3.05
Special Grade: 3.15
High Speed: 3.30All prices per pound of contained vanadium,
f.o.b. our Works with freight charges allowed
to reasonable distance.

Freight surcharge for account of Buyer.

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[fol. 17]

-2-

Electro Metallurgical Sales Corp.
 Typed Price Sheets
 (Contd.)

FERROVANADIUM

Dated - 12/19/32 - Open Hearth Grade: \$2.60
 Special Grade: 2.70
 High Speed Grade: 2.80

All prices per pound contained vanadium, f.o.b.
 our works with freight charges allowed to points
 within a reasonable distance.

1/1/35 - Open Hearth Grade: \$2.70
 Special Grade: 2.80
 High Speed Grade: 2.90

All prices per pound of contained vanadium, f.o.b.
 our Works with freight charges allowed to points
 within a reasonable distance.

VANADIUM OXIDE

Dated - 12/5/28 -	<u>Spot</u>	<u>Contract</u>
		\$1.65
500 lbs. or more	\$1.65	
Less than 500 lbs.	1.75	

The above prices are per pound of contained V_2O_5 ,
 f.o.b. our Works with freight charges allowed.

12/7/31 -	<u>Spot</u>	<u>Contract</u>
		\$1.25
500 lbs. or more	\$1.25	
Under 500 lbs.	1.35	

Above prices per pound of contained V_2O_5 , f.o.b.
 our Works with freight charges allowed.
 Freight surcharge for account of buyer.

12/19/32	<u>Spot</u>	<u>Contract</u>
		\$1.05
500 lbs. or more	\$1.05	
Under 500 lbs.	1.15	

Above prices are per pound contained V_2O_5 , f.o.b.
 our works with freight charges allowed.

-3-

Electro Metallurgical Sales Corp.
Typed Price Sheets
(Contd.)

[Col. 18]

VANADIUM OXIDE

Dated - 1/1/35 -

	<u>Spot</u>	<u>Contract</u>
Any quantity		\$1.10
500 lbs. or more	\$1.10	
Under 500 lbs.	1.20	

All prices are per pound of contained V_2O_5 , f.o.b.
our Works with freight charges allowed to points
within a reasonable distance.

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[fol. 19]

STANDARD PRICES SPECIFIED IN 1937 CONTRACTSFERROVANADIUM

Ferrovanadium, in lump form or crushed to as small as 20 mesh and down, in any quantity:

High Speed Grade	\$2.90
Special Grade	2.80
Open Hearth Grade	2.70

Delivered f.o.b. cars at works or warehouses of Electro Metallurgical Company, with freight charges allowed to destination, excepting to those points taking a freight rate in excess of the St. Louis, Missouri rate; to such points the equivalent of the freight charges to St. Louis will be allowed.

AMMONIUM META VANADATE

Price per pound \$1.90

Delivered f.o.b. cars at works or warehouses of Electro Metallurgical Company, with freight charges allowed to destination, excepting to those points taking a freight rate in excess of the St. Louis, Missouri rate; to such points the equivalent of the freight charges to St. Louis will be allowed.

VANADIUM PENTOXIDE
FUSED AND RED CAKE

Price per pound contained V₂O₅ ... \$1.10

Delivered f.o.b. cars at works or warehouses of Electro Metallurgical Company, with freight charges allowed to destination, excepting to those points taking a freight rate in excess of the St. Louis, Missouri rate; to such points the equivalent of the freight charges to St. Louis will be allowed.

[fol. 20]

STANDARD PRICES SPECIFIED IN 1938 CONTRACTSFERROVANADIUM

Ferrovanadium, in lump form or crushed to as small as 20 mesh and down, in any quantity:

High Speed Grade	\$2.90
Special Grade	2.80
Open Hearth Grade	2.70

Delivered f.o.b. cars at works or warehouses of Electro Metallurgical Company, with freight charges allowed to destination, excepting to those points taking a freight rate in excess of the St. Louis, Missouri rate; to such points the equivalent of the freight charges to St. Louis will be allowed.

AMMONIUM META VANADATE

5,000 lb. or more	\$1.90 per lb.
Less than 5,000 lb.....	2.00 " "

Delivered f.o.b. cars at works or warehouses of Electro Metallurgical Company, with freight charges allowed to destination, excepting to those points taking a freight rate in excess of the St. Louis, Missouri rate; to such points the equivalent of the freight charges to St. Louis will be allowed.

VANADIUM PENTOXIDE
FUSED AND RED CAKE

Price per pound contained V_2O_5 \$1.10

Delivered f.o.b. cars at works or warehouses of Electro Metallurgical Company with freight charges allowed to destination, excepting to those points taking a freight rate in excess of the St. Louis, Missouri rate; to such points the equivalent of the freight charges to St. Louis will be allowed.

[fol. 21]

STANDARD PRICES SPECIFIED IN CONTINUING CONTRACTS
DATED DECEMBER 10, 1938, AND LATER

FERROVANADIUM

FERRO VANADIUM

	Lump, or crushed to as small as 20 mesh x D	48 Mesh x D	65 to 100 Mesh x D	150 or 200 Mesh x D
High Speed Grade				
In any quantity	\$2.90			
Carload Lots		\$2.93	\$2.94	\$2.95
Gross Ton Lots		2.94	2.96	2.98
Less Than Gross Ton Lots, Down to 200 Pounds		2.96	3.00	3.02
Less Than 200 Pounds		3.00	3.10	3.15
Special Grade				
In any quantity	\$2.80			
Carload Lots		\$2.83	\$2.84	\$2.85
Gross Ton Lots		2.84	2.86	2.88
Less Than Gross Ton Lots, Down to 200 Pounds		2.86	2.90	2.92
Less Than 200 Pounds		2.90	3.00	3.05
Open Hearth Grade				
In any quantity	\$2.70			
Carload Lots		\$2.73	\$2.74	\$2.75
Gross Ton Lots		2.74	2.76	2.78
Less Than Gross Ton Lots, Down to 200 Pounds		2.76	2.80	2.82
Less Than 200 Pounds		2.80	2.90	2.95

Delivered f.o.b. cars Niagara Falls, New York, basis with freight charges allowed to destination, except to those points taking a freight rate in excess of the St. Louis, Missouri rate; to such points the equivalent of the freight charges to St. Louis will be allowed.

AMMONIUM META VANADATE

1,000 lb. or more	\$1.90 per lb.
Less than 1,000 lb.	2.00 " "

Delivered f.o.b. cars Niagara Falls, New York, basis, with freight charges allowed to destination, except to those points taking a freight rate in excess of the St. Louis, Missouri rate; to such points the equivalent of the freight charges to St. Louis will be allowed.

VANADIUM PENTOXIDE
PURIFIED AND RED CAKE

Price per pound contained V_2O_5 ..\$1.10

Delivered f.o.b. cars Niagara Falls, New York basis, with freight charges allowed to destination, except to those points taking a freight rate in excess of the St. Louis, Missouri rate; to such points the equivalent of the freight charges to St. Louis will be allowed.

[fol. 22]

**STANDARD PRICES SPECIFIED IN CONTINUING CONTRACTS DATED
NOVEMBER 8, 1943 AND CONTINUING THROUGH DECEMBER 31, 1944**

FERROVANADIUM

EASTERN ZONE

	Lump	2" x D	1" x D	1/4" x D	20 Mesh x D	60 Mesh x D
HIGH SPEED GRADE						
Carload Lots, Bulk or Packed	\$2.90	\$2.90	\$2.90			
2,000 Lb. Up to Carload, Packed..	2.90	2.90	2.90			
Less Than 2,000 Lb., Packed	2.90	2.90	2.90			
SPECIAL GRADE						
Carload Lots, Bulk or Packed		2.80	2.80		\$2.80	
2,000 Lb. Up to Carload, Packed..		2.80	2.80		2.80	
Less Than 2,000 Lb., Packed		2.80	2.80		2.80	
OPEN HEARTH GRADE						
Carload Lots, Bulk or Packed	2.70	2.70	2.70	\$2.70		\$2.74
2,000 Lb. Up to Carload, Packed..	2.70	2.70	2.70	2.70		2.76
Less Than 2,000 Lb., Packed	2.70	2.70	2.70	2.70		2.80

CENTRAL ZONE

HIGH SPEED GRADE						
Carload Lots, Bulk or Packed	\$2.917	\$2.917	\$2.917			
2,000 Lb. Up to Carload, Packed..	2.924	2.924	2.924			
Less Than 2,000 Lb., Packed	2.924	2.924	2.924			
SPECIAL GRADE						
Carload Lots, Bulk or Packed		2.817	2.817		\$2.817	
2,000 Lb. Up to Carload, Packed..		2.824	2.824		2.824	
Less Than 2,000 Lb., Packed		2.824	2.824		2.824	
OPEN HEARTH GRADE						
Carload Lots, Bulk or Packed	2.717	2.717	2.717	\$2.717		\$2.767
2,000 Lb. Up to Carload, Packed..	2.724	2.724	2.724	2.724		2.764
Less Than 2,000 Lb., Packed	2.724	2.724	2.724	2.724		2.824

WESTERN ZONE

HIGH SPEED GRADE						
Carload Lots, Bulk or Packed	\$2.962	\$2.962	\$2.962			
2,000 Lb. Up to Carload, Packed..	2.985	2.985	2.985			
Less Than 2,000 Lb., Packed	2.985	2.985	2.985			
SPECIAL GRADE						
Carload Lots, Bulk or Packed		2.862	2.862		2.862	
2,000 Lb. Up to Carload, Packed..		2.885	2.885		2.885	
Less Than 2,000 Lb., Packed		2.885	2.885		2.885	
OPEN HEARTH GRADE						
Carload Lots, Bulk or Packed	2.762	2.762	2.762	2.762		2.802
2,000 Lb. Up to Carload, Packed..	2.785	2.785	2.785	2.785		2.845
Less Than 2,000 Lb., Packed	2.785	2.785	2.785	2.785		2.885

All prices mentioned above are per pound of vanadium contained in the alloy.

Delivered f.o.b. cars works or warehouses of the Seller with railroad freight charges allowed to destination (in the respective zones).

[fol. 23]

-2-

STANDARD PRICES SPECIFIED IN CONTINUING CONTRACTS DATED
NOVEMBER 8, 1943 AND CONTINUING THROUGH DECEMBER 31, 1944

(Continued)

AMMONIUM META VANADATE

1,000 lbs. or more	\$1.90 per lb.
Less than 1,000 lbs.....	2.00 " "

Delivered f.o.b. cars works or warehouses of the Seller with
railroad freight charges allowed to destination.

VANADIUM PENTOXIDE
FUSED AND RED CAKE

In Any Quantity	\$1.10 per pound contained V205
-----------------------	------------------------------------

Delivered f.o.b. cars works or warehouses of the Seller with
railroad freight charges allowed to destination,

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[fol. 24]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 5

[Handwritten notation—VCA]

1933 FERRO ALLOY PRICES 12-20-32 Sheet 5

FERRO VANADIUM

CONTRACT
AND
SPOT

Grade "A" Open Hearth	\$2.60
Grade "B" Crucible	2.70
Grade "C" Primos	2.80

Per pound of contained Vanadium, F.O.B. cars Bridgeville, Penna. with Freight allowed and prepaid to points east of the Mississippi and north of Baltimore. (SPOT:— freight allowed only on quantities of 50# and over)

VANADIUM PENTOXIDE (TECHNICAL)

Ton lots and contract	\$1.05
Less ton lots, spot	1.15

Per pound of V205 contained, F.O.B. Bridgeville, Penna. with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore (Spot:— freight allowed on quantities of 50# and up)

AMMONIUM META VANADATE (TECHNICAL)

Spot and contract	\$1.90
-------------------------	--------

Per pound net, F.O.B. Bridgeville, Penna. with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore. (Spot:— freight allowed on quantities of over 50#)

TERMS:— NET CASH THIRTY DAYS — NEW YORK
EXCHANGE

[fol. 25]

PAGE FIVE

12/18/33

FERRO VANADIUM

[Handwritten notation—1934]

CONTRACT & SPOT PRICES

Grade "A" Open Hear ⁴	\$2.70 per lb contained Vanadium
Grade "B" Crucible	2.80 " " " "
Grade "C" Primos	2.90 " " " "

F.O.B. cars Bridgeville, Penna. with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore. (Freight allowed only on quantities of 50# and over.)

VANADIUM PENTOXIDE (TECHNICAL)

Contract, any quantity	
and 500# or more, spot	\$1.10
Under 500#, spot	1.20

Per pound of contained V205 F OB Bridgeville, Penna. with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore. (Freight allowed only on quantities of 50# and over.)

AMMONIUM METAL VANADATE (TECHNICAL)

Spot and contract	\$2.00
-------------------------	--------

Per pound net F.O.B. Bridgeville, Penna. with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore. (Freight allowed on quantities of over 50#.)

LOW CARBON FERRO TITANIUM

Contract and spot \$1.40 per lb. contained Ti

~~F.O.B. Suspension Bridge, N. Y. or~~ Bridgeville, Pa.

TERMS:— NET CASH 30 DAYS — NEW YORK FUNDS

[fol. 26]

Page Five

January 22, 1935

FERRO VANADIUM

FERRO VANADIUM

[Handwritten notation—1935]

CONTRACT AND SPOT PRICES

Grade "A" Open Hearth	\$2.70 per lb contained Vanadium
Grade "B" Crucible	2.80 per lb contained Vanadium
Grade "C" Primos	2.90 per lb contained Vanadium

F.O.B. cars Bridgeville, Penna., with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore.

(Freight allowed only on quantities of 50 lbs and over)

VANADIUM PENTOXIDE (TECHNICAL)VANADIUM PENTOXIDE

Contract, any quantity and 500# or more, spot	\$1.10
Under 500#, spot	1.20

Per pound of contained V2O5

F.O.B. Bridgeville, Penna., with freight allowed and prepaid to points east of the Mississippi Rr and north of Baltimore.
(Freight allowed only on quantities of 50# and over)

AMMONIUM META VANADATE (TECHNICAL)AMMONIUM VANADATE

Spot and Contract	\$2.00
-------------------------	--------

Per pound net

F.O.B. Bridgeville, Penna., with freight allowed and prepaid to points east of the Mississippi Rr and north of Baltimore.
(Freight allowed on quantities of 50# and over)

LOW CARBON FERRO TITANIUMLOW CARBON FERRO TITANIUM

Contract and Spot	\$1.40 per lb. contained Ti
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F.O.B. Bridgeville, Pennsylvania

TERMS: NET CASH THIRTY DAYS — NEW YORK FUNDS UNLESS OTHERWISE SPECIFIED

[fol. 27]

Page 5
12/11/35

[Handwritten notation—1936]

FERRO VANADIUM

FERRO VANADIUM

CONTRACT & SPOT PRICES

Grade "A" Open Hearth	\$2.70	per pound of contained Vanadium
Grade "B" Crucible	2.80	" " " "
Grade "C" Primos	2.90	" " " "

F.O.B. Cars Bridgeville, Penna. with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore.

(Freight allowed only on quantity of 50# and over)

VANADIUM PENTOXIDE, TECHNICALVANADIUM PENTOXIDE, TECH.

Contract, any quantity, and 500# or more, spot	\$1.10
Under 500#, spot	1.20

Per pound of contained V2O5

F.O.B. Bridgeville, Penna. with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore.
(Freight allowed only on quantities of 50# and over)

AMMONIUM META VANADATE (TECHNICAL)AMMONIUM VANADATE

Contract and spot	\$2.00
1,000# or over	1.90
Contract minimum over period of one year 1,000	1.90

All per pound net, F.O.B. Bridgeville, Penna. with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore.

(Freight allowed on quantities of 50# and over)

TERMS: (NET CASH THIRTY DAYS—NEW YORK FUNDS UNLESS OTHERWISE SPECIFIED—ON ALL PRODUCTS LISTED IN THIS PRICE LIST).

[fol. 28]

December 10, 1936

VANADIUM PENTOXIDE, TECHNICAL

Air Dried
and
Fused

Contract, any quantity, and
500# or more, spot .. \$1.10 per pound of contained V₂O₅

Spot, 1 to 9# lots 1.25 per pound net
" 10 to 499# 1.15 per pound contained V₂O₅

F.O.B. Bridgeville, Penna. with freight allowed and pre-
paid to points east of the Mississippi River and north of
Baltimore.

(freight allowed only on quantities of 50# and over)

Terms:—net cash 30 days

December 10, 1936

**FERRO VANADIUM
CONTRACT AND SPOT PRICES**

Grade "A" Open Hearth	\$2.70 per pound of contained Vanadium
“ “B” Crucible	2.80 per pound of contained Vanadium
“ “C” Primos	2.90 per pound of contained Vanadium

F.O.B. cars Bridgeville, Penna. with freight allowed and prepaid to points east of the Mississippi River and north of Baltimore.

Freight allowed only on quantities of 50# and over.

Terms: Net cash 30 days.

[fol. 30]

1934
Price List
effective 1/1/34

PRICES

	<u>1</u>	<u>2</u>	<u>3</u>
Grade "A" Open Hearth	31/40	1" 1/2	3.50 1/2
Grade "B" Crucible	32/42	3.50	3.50
Grade "C" Primos	32/42	1.00	2.00

Contract PricesNet Prices

Grade "A" Open Hearth	2.90	2.90
Grade "B" Crucible	2.90	2.90
Grade "C" Primos	2.90	2.90

<u>Contract</u>	<u>100 m x d</u>	<u>Longer than 200"</u>
200" x 4"	2.91 1/2	3.18
Primos	2.91 1/2	3.24
	3.01 1/2	3.34

All are round of continued Veneer. 04.

Spot - 104 & 110 higher.

W. J. Lee Works, Bridgeton, Pa.
Weight of mild and allowed, on 204 and over except to points farther
rate in excess of the St. Louis, Mo. rate.
Leaving freight allowance based on rate to St. Louis, Mo.

30

Terms: net cash thirty days

[fol. 31]

1936
Price List
Effective 1/1/36

VANADIN PEROXIDE, TECHNICAL

Air Dried or Fused Form

Contract Price

Any quantity \$1.10 per pound of contained V_2O_5

Spot Prices

500# and over \$1.15 per pound contained V_2O_5

10 to 499# 1.20 per pound contained V_2O_5

9# and under 1.25 per pound net

8CK
10-15

1000#	—	9.10
200#	—	.33
100#	—	.18
50#	—	.21
25#	—	.24
10#	—	.34
5#	—	.34
1#	—	.34
1/2#	—	.34
1/4#	—	.34
1/8#	—	.34
1/16#	—	.34
1/32#	—	.34
1/64#	—	.34
1/128#	—	.34
1/256#	—	.34
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[fol. 32]

1939
Price List
Effective 1/1/36

FERRO VANADIUM

	% V	% Si	% C
Grade "A" Open Hearth	35/40	12 max.	3.50 max.
Grade "B" Crucible	35/45	3.50 max.	.50 max.
Grade "C" Primos	35/45	1.25 max.	.20 max.

	* CONTRACT PRICES	SPOT PRICES
Grade "A" Open Hearth	\$2.70	\$2.80
Grade "B" Crucible	2.80	2.90
Grade "C" Primos	2.90	3.00

All per pound of contained Vanadium

F.O.B. our works, Bridgeville, Pennsylvania.

Freight prepaid and allowed, except to points taking a rate in excess of the St. Louis, Missouri rate, on fifty pounds and over. Maximum freight allowance based on rate to St. Louis, Missouri.

Terms: Net cash thirty days.

1939
Price List
Effective 1/1/39

VANADIUM PENTOXIDE, TECHNICAL

Air Dried or Fused Form

CONTRACT PRICE

Any quantity \$1.10 per pound of contained V_2O_5

SPOT PRICE

500 pounds and over .. \$1.15 per pound of contained V_2O_5

10 to 499 pounds 1.20 per pound of contained V_2O_5

9 pounds and under .. 1.25 per pound net

F.O.B. our works, Bridgeville, Pennsylvania.

Freight prepaid and allowed on quantities of fifty pounds and over except to points taking a rate in excess of the St. Louis, Missouri rate. Maximum freight allowance based on rate to St. Louis, Missouri.

Terms: Net cash thirty days.

[fol. 34]

✓
1940
Price List
Effective 1/1/40

FERRO VANADIUMLump, crushed or ground as fine as 20 mesh & down

	<u>\$ V</u>	<u>\$ S</u>	<u>\$ C</u>
Grade "A" Open Hearth	35/40	12 max.	3.50 max.
Grade "B" Crucible	35/45	3.50 max.	.50 max.
Grade "C" Primos	35/45	1.25 max.	.30 max.

	<u>CONTRACT PRICES</u>	<u>SPOT PRICES</u>
Grade "A" Open Hearth	\$2.70	\$2.80
Grade "B" Crucible	2.80	2.90
Grade "C" Primos	2.90	3.00

Prices per pound of contained Vanadium

F.O.B. cars Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case the maximum freight allowance will be based on the freight rate to St. Louis Missouri.

Terms: Net cash thirty days

34

[fol. 35]

1940
Price List
Effective 1/1/40

VANADIUM PENTOXIDE TECHNICAL

Air Dried or Fused Form

CONTRACT PRICE

Any quantity\$1.10 per pound contained V205

SPOT PRICE

500 pounds and over.....\$1.15 per pound contained V205
10 to 499 pounds 1.20 per pound contained V205
Under 10 pounds 1.25 per pound net

STANDARD SIZES:

Air Dried - Powder

Fused - Crushed approx. 3/4" x down, however will furnish material at no extra crushing charge for sizes down to and including 1/4" x down. Crushing extras for smaller sizes as follows:

8 Mesh x down

20 Mesh x down

Ton Lots \$0.015 per lb ctd V205 \$0.0175 per lb ctd V205

Less Ton Lots

200 pounds and up 0.02 per lb ctd V205 0.03 per lb ctd V205
Under 200 pounds 0.03 per lb ctd V205 0.04 per lb ctd V205

For sizes smaller than 20 mesh x down refer to New York office.

F.O.B. cars Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days.

Page 14
1940

[fol. 36]

VANADIUM CORPORATION OF AMERICA

Price List
Effective
January 1st, 1941

FERRO VANADIUM

Lump, crushed or ground as fine as 20 mesh x down

	<u>\$ V</u>	<u>\$ Si</u>	<u>\$ C</u>
Grade "A" Open Hearth	35/40	12 max.	3.50 max.
Grade "B" Crucible	35/45	3.50 max.	.50 max.
Grade "C" Primes	35/45	1.25 max.	.20 max.

	<u>CONTRACT PRICES</u>	<u>SPOT PRICES</u>
Grade "A" Open Hearth	\$2.70	\$2.80
Grade "B" Crucible	2.80	2.90
Grade "C" Primes	2.90	3.00

Prices per pound of contained Vanadium

F.O.B. cars Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days

NOTE: The above prices shall be in effect until March 31, 1941 and thereafter for each calendar quarter-year unless revised in writing by Seller at least fifteen days prior to such quarter-year.

[fol. 37]

VANADIUM CORPORATION OF AMERICA

Price List
Effective
January 1st, 1941

VANADIUM PENTOXIDE, TECHNICALAir Dried or Fused FormCONTRACT PRICE

Any quantity - - - - - \$1.10 per pound contained V205

SPOT PRICE

500 pounds and over - - - - - \$1.15 per pound contained V205
10 to 499 pounds - - - - - 1.20 per pound contained V205
Under 10 pounds - - - - - 1.25 per pound net

STANDARD SIZES:

Air Dried - Powder

Fused - Crushed approx. $3/4"$ x down, however will furnish material at no extra crushing charge for sizes down to and including $1/4"$ x down. Crushing extras for smaller sizes as follows;

<u>Ton Lots</u>	<u>8 Mesh x down</u> \$0.015 per lb. ctd. V205	<u>20 Mesh x down</u> \$0.0175 per lb. ctd. V205
<u>Less Ton Lots</u>		
200 pounds and up	0.02 per lb. ctd. V205	0.03 per lb. ctd. V205
Under 200 pounds	0.03 per lb. ctd. V205	0.04 per lb. ctd. V205

For sizes smaller than 20 mesh x down refer to New York Office.

F.O.B. cars Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days

NOTE: The above prices shall be in effect until March 31, 1941 and thereafter for each calendar quarter-year unless revised in writing by Seller at least fifteen days prior to such quarter-year.

[fol. 38]

VANADIUM CORPORATION OF AMERICA

Price List
Effective
January 1st, 1942

FERRO VANADIUM

Lump, crushed or ground as fine as 20 mesh x down

	<u>% V</u>	<u>% Si</u>	<u>% C</u>
Grade "A" Open Hearth	95/100	12 MAX.	3.50 MAX.
Grade "B" Crucible	35/15	3.50 MAX.	.50 MAX.
Grade "C" Primos	35/15	1.25 MAX.	.20 MAX.

	<u>CONTRACT PRICES</u>	<u>SPOT PRICES</u>
Grade "A" Open Hearth	\$ 2.70	\$ 2.80
Grade "B" Crucible	2.80	2.90
Grade "C" Primos	2.90	3.00

Prices per pound of contained Vanadium

F.O.B. cars Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days

NOTE: The above prices shall be in effect until March 31, 1942 and thereafter for each calendar quarter-year unless revised in writing by Seller at least fifteen days prior to such quarter-year.

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[fol. 39]

VANADIUM CORPORATION OF AMERICA

Price List
Effective
January 1st, 1942

VANADIUM PENTOXIDE, TECHNICALAir Dried or Paced FormCONTRACT PRICE

Any quantity - - - - - \$1.10 per pound contained V205

SPOT PRICE

500 pounds and over - - - - - \$1.15 per pound contained V205
 10 to 499 pounds - - - - - 1.20 per pound contained V205
 Under 10 pounds - - - - - 1.25 per pound net

STANDARD SIZES:Air Dried - Powder

Paced - Crushed approx. $3/4"$ x down, however will furnish material at no extra crushing charge for sizes down to and including $1/4"$ x down. Crushing extras for smaller sizes as follows:

	8 Mesh x down	20 Mesh x down
Ten Lots	\$0.015 per lb. std. V205	\$0.0175 per lb. std. V205
Less Ten Lots		
200 pounds and up	0.02 per lb. std. V205	0.03 per lb. std. V205
Under 200 pounds	0.03 per lb. std. V205	0.04 per lb. std. V205

For sizes smaller than 20 mesh x down refer to New York Office.

F.O.B. cars Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days

NOTE: The above prices shall be in effect until March 31, 1942 and thereafter for each calendar quarter-year unless revised in writing by Seller at least fifteen days prior to each quarter-year.

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VANADIUM CORPORATION OF AMERICA

Price List
Effective
January 1st, 1942

FERRO VANADIUM

Lump, crushed or ground as fine as 20 mesh x down

	<u>% V</u>	<u>% Si</u>	<u>% C</u>
Grade "A" Open Hearth	35/100	12 max.	3.50 max.
Grade "B" Crucible	35/15	3.50 max.	.50 max.
Grade "C" Primes	35/15	1.25 max.	.20 max.

	<u>CONTRACT PRICES</u>	<u>SPOT PRICES</u>
Grade "A" Open Hearth	\$ 2.70	\$ 2.80
Grade "B" Crucible	2.80	2.90
Grade "C" Primes	2.90	3.00

Prices per pound of contained Vanadium

F.O.B. cars Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days

NOTE: The above prices shall be in effect until March 31, 1942 and thereafter for each calendar quarter-year unless revised in writing by Seller at least fifteen days prior to such quarter-year.

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VARADIKU CORPORATION OF AMERICA

Price List
Effective
January 1st, 19

VARADIKU PHOSPHORUS, TECHNICALAir Dried or Paced FormCONTRACT PRICE

Any quantity - - - - - \$1.10 per pound contained V205

SPOT PRICE

500 pounds and over - - - - - \$1.15 per pound contained V205
10 to 499 pounds - - - - - 1.20 per pound contained V205
Under 10 pounds - - - - - 1.25 per pound net

STANDARD SIZES:Air Dried - Powder

Paced - - Crushed approx. $3/4"$ x down, however will furnish material at no extra crushing charge for sizes down to and including $1/4"$ x down. Crushing extras for smaller sizes as follows:

<u>Ton Lots</u>	8 Mesh x down \$0.015 per lb. std. V205	20 Mesh x down \$0.0175 per lb. std. V205
<u>Less Ton Lots</u>		
200 pounds and up	0.02 per lb. std. V205	0.03 per lb. std. V205
Under 200 pounds	0.03 per lb. std. V205	0.04 per lb. std. V205

For sizes smaller than 20 mesh x down refer to New York Office.

F.O.B. care Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such cases the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days

NOTE: The above prices shall be in effect until March 31, 1942 and thereafter for each calendar quarter-year unless revised in writing by Seller at least fifteen days prior to each quarter-year.

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[fol. 42]

VANADIUM CORPORATION OF AMERICA

Price List
Effective
January 1st, 19...

PRIMO VANADIUM

lump, crushed or ground as fine as 20 mesh & down

	<u>\$ V</u>	<u>\$ 51</u>	<u>\$ C</u>
Grade "A" Open Hearth	54/40	12 max	3 40 max
Grade "B" Crucible	35/45	3 40 max.	50 max
Grade "C" Prime	35/45	2 25 max.	50 max

	<u>CONTRACT PRICES</u>	<u>SPOT PRICES</u>
Grade "A" Open Hearth	\$ 2 70	\$ 2 80
Grade "B" Crucible	2 90	2 00
Grade "C" Prime	2 90	3 00

Prices per pound of contained Vanadium

F.O.B. care Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over, provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case, the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days

NOTE: The above prices shall be in effect until March 1, 19... and thereafter for each calendar quarter-year, unless revised in writing by Seller at least fifteen days prior to each quarter-year.

[fol. 43]

INDUSTRIAL SUPPLY CO. OF AMERICAPrice List
Effective
January 1, 1942INDUSTRIAL SUPPLY CO. OF AMERICAAir Freight or Parcel PostSHIPPING CHARGES

Any quantity ----- \$1.10 per pound contained VMS

WEIGHT PRICES

500 pounds and over -----	\$1.10 per pound contained VMS
10 to 499 pounds -----	1.20 per pound contained VMS
Under 10 pounds -----	1.30 per pound net

SHIPPING ALLOWANCE:
25¢ per lb. - Parcel

Parcel - Shrinkage approx. 1/4" x 1/2" x 1/2", however will furnish material at no extra shrinkage charge for sizes down to and including 1/4" x 1/2" x 1/2". Shrinkage extra for smaller sizes as follows:

	<u>1/4" thick x 1/2"</u>	<u>1/2" thick x 1/2"</u>
<u>25¢ per lb.</u>	\$0.015 per lb. std. VMS	\$0.015 per lb. std. VMS

Large Size Lots

<u>25¢ per lb. and up</u>	0.02 per lb. std. VMS	0.02 per lb. std. VMS
<u>Under 25¢ per lb.</u>	0.02 per lb. std. VMS	0.02 per lb. std. VMS

For sizes smaller than 25¢ each x 1/2" refer to New York Office.

F.O.B. care Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days

NOTE: The above prices shall be in effect until March 31, 1942 and thereafter for each calendar quarter-year unless revised or revised by contract or letter fifteen days prior to each quarter-year.

[fol. 44]

VANADIUM CORPORATION OF AMERICA

Price List
Effective
January 1, 1945

ZERO VANADIUM**Vanadium crushed or ground as fine as 20 Mesh & down**

	<u>£ V</u>	<u>£ 51</u>	<u>£ C</u>
Grade "A" Open Hearth	35/40	12 MAX.	1.50 MAX.
Grade "B" Crucible	35/45	3.50 MAX.	.50 MAX.
Grade "C" Prime	35/45	1.25 MAX.	.20 MAX.

	<u>CONTRACT PRICES</u>	<u>SPOT PRICES</u>
Grade "A" Open Hearth	\$ 2.70	\$ 2.80
Grade "B" Crucible	2.80	2.90
Grade "C" Prime	2.90	3.00

Prices per pound of contained Vanadium

F.O.B. care Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over, provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case, the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days

NOTE: The above prices shall be in effect until March 31, 1945 and thereafter for each calendar quarter-year, unless revised in writing by Seller at least fifteen days prior to each quarter-year.

[fol. 45]

YAMADU CORPORATION OF AMERICAPrice List
Effective
January 1, 1963YAMADU PEROXIDE, TECHNICALAir Dried or Panned FormCONTRACT PRICEAny quantity ----- \$1.10 per pound contained V_2O_5 SPOT PRICE

300 pounds and over ----- \$1.15 per pound contained V_2O_5
 10 to 299 pounds ----- 1.20 per pound contained V_2O_5
 Under 10 pounds ----- 1.25 per pound net

STANDARD SIZES:

Air Dried - Powder

Panned - Crushed approx. $3/4"$ x down, however will furnish material at no extra crushing charge for sizes down to and including $1/4"$ x down. Crushing extras for smaller sizes as follows:

	<u>8 Mesh x down</u>	<u>20 Mesh x down</u>
<u>Ton lots</u>	\$0.015 per lb. std. V_2O_5	\$0.0175 per lb. std. V_2O_5

Less Ton lots

200 lbs. and up	0.02 per lb. std. V_2O_5	0.03 per lb. std. V_2O_5
Under 200 lbs.	0.03 per lb. std. V_2O_5	0.04 per lb. std. V_2O_5

For sizes smaller than 20 mesh x down refer to New York Office.

F.O.B. cars Bridgeville, Pennsylvania. Freight allowed on quantities of twenty-five pounds and over provided that the freight rate does not exceed the rate to St. Louis, Missouri. In such case the maximum freight allowance will be based on the freight rate to St. Louis, Missouri.

Terms: Net cash thirty days.

NOTE: The above prices shall be in effect until March 31, 1963 and thereafter for each calendar quarter-year unless revised in writing by Seller at least fifteen days prior to each quarter-year.

[fol. 46]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 10

IN UNITED STATES DISTRICT COURT

U. S. D. C. 12

738 B

VANADIUM CORPORATION OF AMERICA

PURCHASING DEPARTMENT

480 LEXINGTON AVE. NEW YORK, N. Y.

P. A. R. T. COPY

Electro Metallurgical Sales Corporation
20 East 42nd Street
New York City
November 12, 1938.
NY BNY 3088
New York

PLEASE REFER TO THE FOLLOWING MATERIAL SUBJECT TO ALL CONDITIONS PRINTED ON REVERSE SIDE OF THIS ORDER. PROVIDED ON DATE OF COUNTRY INVOICE IN TRIPLICATE AND BILL OF LADING SHOWN ABOVE ORDER BEING SENT TO BRIDGEVILLE, PA.

- Material - "Electrumet" Brand Vanadium Pentoxide (V₂O₅) as previous.
- Quantity - Approximately One Hundred Thirty Thousand (130,000) pounds V₂O₅
- Price: - Eighty cents (\$.80) per pound of V₂O₅, f.o.b. cars at Seller's works, with freight allowed to Bridgeville, Pa., or delivered Bridgeville, Pa. by truck.
- Terms - Net cash thirty (30) days from date of invoice.
- Delivery - To be shipped at once -
25,000 to 30,000 pounds from Columbian via truck
30,000 to 100,000 pounds from Duran, Colorado via freight

Outstanding arrangements made between Mr. John Smith and Mr. F. J. Gibbons.

11/18 - 10,212 lbs	8167.60	38-11-3574
11/19 - 9,835.918	7885.58	38-11-3574
11/19 - 9,842.614	7870.14	38-11-3574
11/19 - 100,000 lbs	78016.50	38-11-4264
130,000 lbs	104,046.82	

THIS ORDER BEING PLACED WITH ABOVE ORDER SPECIAL. SPECIAL AGREEMENTS BEING OF THE ORDER BEING THE ORDER WILL BE FURNISHED.

VANADIUM CORPORATION OF AMERICA
BRIDGEVILLE, PA.
V. J. Gibbons
V. J. Gibbons
BRIDGEVILLE, PA.

[fol. 47]

FILE NO. 584

738 D

VANADIUM CORPORATION OF AMERICA**PURCHASING DEPARTMENT**

480 LEXINGTON AVE., NEW YORK, N. Y.

PALESTINE

Electro Metallurgical Sales Corporation

June 24, 1959.

NO POST-GRAD STUDENT

NY BNY 3797

New York City

P. J. G.

P. 1 - John Swain

PLEASE FORWARD TO THE FOLLOWING MAILING SUBJECT TO ALL CONDITIONS PRINTED ON REVERSE SIDE OF THIS ORDER. ORDERED BY NAME OF COMPANY STOCK, IN THE CASE AND BILL OF LADING SHIPPER AND/OR ORDER SHOULD BE SENT TO **AMERICAN TRADING CO. 450 Lexington Avenue, New York City**

Materials:	Vanadium Pentoxide (V_2O_5) - to be shipped from Brown
Quantity:	One (1) car - 10 <i>9250 Net - 93750.30 Ctr</i> <i>Savoy Fire Arms (15)</i>
Price:	<i>Nightly Rate (\$4.00)</i> per pound of contained V_2O_5 , f.o.b. Bridgeville, Pa.
Terms:	Net cash thirty (30) days from date of invoice.
Delivery:	To be shipped at once.

7-10-68
1. R. H. W. - 61310 from London
2. R. H. W. - C.E. 3. W.P. - 4. E. - 5. W. V.

Confirming arrangements made between Mr. John Swain
and Mr. P. J. Gibbons.

PLEASE SIGN FOREIGN PLANTY WITH ABOVE ORDER FORM. EARLY ACKNOWLEDGE RECEIPT OF THIS ORDER STATES
YOUR ORDER WILL GO FORWARD.

TO
VANADUM CORPORATION OF AMERICA
BRIDGEVILLE, PA.

VANADIUM CORPORATION OF AMERICA

R. I. Bonker

PREPARING AGENT
 052

[fol. 48]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT NO. 14

IN UNITED STATES DISTRICT COURT

Item 9 - Purchases

<u>Year</u>	<u>Commodity</u>	<u>Price</u>
1933	Vanadium Ore Concentrates	\$.80 per lb. V205 Delivered
1934	Flue Dust	.30 " " " Shipping Point
1935	Vanadium Ore Concentrates	.80 " " " Delivered
1936	" " " Pentoxide	.80 " " " " Plus Emergency Freight Charge
1937	" " "	.80 " " " " " "
1938	" " "	1.10 " " " " "
	" " "	.80 " " " " "
1939	" " "	1.18 " " " " " Less Freight
	" " "	.80 " " " " "
	" " "	.65 " " " " "
1940	" " "	.75 " " " " "
	Vanadium bearing Petroleum Residue	.60 " " " " " Less Freight
	Catalytic Mass Waste Material	.35 " " " " "
	Ammonium Meta Vanadate	1.90 " " " " "
1941	Flue Dust	.50 " " " " New York
	Ammonium Meta Vanadate	1.90 " " " " Delivered
	Vanadium bearing Petroleum Residue	.50 " " " " New York
	Sodium Vanadate	.80 " " " " Delivered
	Flue Dust	.60 " " " " New York
	" " "	.665 " " " " " Plus 1/2 analysis cost
	Vanadium bearing Petroleum Residue	.55 " " " " " "
	" " Slag	.60 " " " " " "
	Calcium Vanadate	6.90 per lb. Delivered New York
	Vanadium bearing Flue Dust	.65 " " " V205 New York Plus 1/2 analysis cost
1942	Flue Dust	.60 " " " " New York
	Sodium Vanadate	.80 " " " " Delivered Less Freight
	Vanadium Oxide	.95 " " " " "
	" bearing Residue	.55 " " " " New York
	Flue Dust (2,000 lbs.)	10.00 for lot Delivered Buffalo
	" " Trial Lot	No Charge New York
	Vanadium bearing Petroleum Residue	.55 per lb. V205 Delivered New York
	" Ashes	.50 " " " FOB Peru Ocean Freight Ins.Duties
	Gas Dried Mud Cake	1.10 " " " " Delivered
	Vanadium Slag	.55 " " " " Shipping Point Plus Prepaid Freight
	Vanadic Acid	1.10 " " " " Delivered
	Furnace Bottoms	.60 " " " " "
	Flue Dust	.605 " " " " Rayonne, N. J.

[fol. 49]

- 2 -

<u>Year</u>	<u>Commodity</u>	<u>Price</u>
1942 (Cont'd)	Fused Vanadium Oxide	\$ 1.00 per Lb. V2O5 Delivered Plus 1/2 Analysis Cost
	Vanadium Concentrates	1.00 " " " " " "
	" Pentoxide	.60 " " " " " "
	Vanadium Petroleum Residue	.40 " " " New York
	Sodium Vanadate	.60 " " " Delivered Less Freight
1943	Vanadium Pentoxide	1.00 " " " " " "
	Flue Dust	.50 " " " Bayonne, N. J.
	" "	.60 " " " " " "
	" "	.40 " " " " " "
	Vanadium Bearing Slag	.50 " " " Shipping Point Plus 1/2 Analysis Cost
	Vanadium Bearing Slag	.40 " " " " " "
	Flue Dust	.40 " " " New York
	" "	.60 " " " Shipping Point
	Sodium Vanadate	.60 " " " Delivered Less Freight
	Flue Dust	.45 " " " New York
	" "	.25 " " " Shipping Point
	Vanadium Ashes	.50 " " " Peru, S.A. Ocean Freight Surcharges, etc.
	Flue Dust	.20 " " " Bayonne, N. J.
	Vanadium Residue	.50 " " " Delivered Less Freight
	Flue Dust	.50 " " " New York
	Residue Vanadium Pentoxide	.85 " " " Delivered
	Flue Dust	.60 " " " New York
	Waste Material	.35 " " " Delivered
1944	Flue Dust	.45 " " " New York Plus 1/2 analysis Cost
	Vanadium Pentoxide	1.00 " " " Delivered Plus 1/2 Analysis Cost
	Flue Dust	.50 " " " Bayonne, N. J.
	" "	.45 " " " New York Plus 1/2 Analysis Cost
	" "	.50 " " " " " " " "
	Ammonium Meta Vanadate	1.90 per Lb. Delivered
	Flue Dust	.40 " " " V2O5 New York Plus 1/2 Analysis Cost
	" "	.50 " " " Bayonne, N. J.
	Sodium Vanadate Residue	.60 " " " Less Freight

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[fol. 50]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 15

IN UNITED STATES DISTRICT COURT

✓ *Plaintiffs' Exhibit No. 15*

STATEMENT OF PURCHASES
 (EXCLUDING VANADIUM BEARING ORE, FLUE DUST,
VANADIC ACID AND FERROVANADIUM)

Article	Date of Purchase	Seller	Quantity	Price Paid	Any Allowances
<u>Electro Metallurgical Co.</u> <u>Niagara Falls, N.Y.</u>					
Ammonium Metavanadate	9/25/33	Vanadium Corp. of America	300 Lbs.	\$1.4500 Lb.	-
" "	10/12/33	" " " "	200 "	1.4500 "	-
Ferrovandium	7/6/44	Vanadium Corp. of America	60000.54 Lbs.V	2.900 "V	-
Vanadium Oxide	6/10/41	Vitro Mfg. Co.	31390 Lbs.V ₂ O ₅	1.025 "V ₂ O ₅	-
" "	11/4/41	" " "	27351.21 " "	1.075 " "	-
" "	12/30/41	" " "	16979.44 " "	1.075 " "	-
" "	2/10/42	" " "	9846.16 " "	1.075 " "	-
" "	2/27/42	" " "	10416.47 " "	1.075 " "	-
" "	4/2/42	" " "	1365.73 " "	1.075 " "	-
" "	4/2/42	" " "	8591.88 " "	1.075 " "	-

UNITED STATES VANADIUM CORPORATION, PLANT VP

URAVAN, COLORADO

VANADIUM-BEARING MATERIALS PURCHASED (EXCLUDING VANADIUM ORE)

January, 1936, to July, 1945

<u>Date Paid</u>	<u>Vendor</u>	<u>Purchase Order</u>	<u>Date Received</u>	<u>Pounds V205</u>	<u>Value</u>	
	J. B. Claybaugh & Ben H. Simpson	PC#7963	4/3/40	234.53*	49.25	Ore Tailings
	J. B. Claybaugh & Ben H. Simpson	PC#7963	4/40	1,079.87	917.89	Red Cake
	Mesa Mines	PC#8063	5/40	680.17	576.14	Red Cake
7/31/40	Brown & Bowman	PC#8608	7/40	9,186.50	8,267.85	Fused Oxide
8/28/40	Brown & Bowman	PC#8772 PC#8857	8/15/40	1,460.00	(250.00 (165.00	(Furnace Brick 1420# (Fused Oxide 40#
8/12/40	Gateway Alloys, Inc.	PC#8716	8/12/40	1,042.01	884.88	Red Cake
7/11/41	Nisley & Wilson	PC#3106	7/41	4,336.20	3,642.41	Red Cake
7/11/41	Nisley & Wilson	PC#3108		109.00	91.56	Red Cake
	North Continent Mines, Inc.	PC#7936 (11/3/42)	10/42	9,383.517	5,160.93	Fusion Furnace Residue & 210# Red Cake
	North Continent Mines, Inc.	PC#8951 (3/18/43)	3/43	4,250.6	2,337.83	Fusion Furnace Residue
	Nisley & Wilson (Hauling on above tailings)	PC#9152 (4/22/43)	4/1/43 to 4/14/43	*	935.99 2,461.03	Gateway Tailings. No V205 content shown. Paid for as 935.488 dry tons @ \$1.00 per ton.
	H. I. Gardner (Hauling on above tailings)	PC#9556 (6/26/43)	6/43	*	365.86 730.09	Gateway Tailings. No V205 content shown. Paid for as 365.875 dry tons @ \$1.00 per ton.
	Nisley & Wilson	PC#11401	3/2/44	2,164.48	1,082.24	Fusion Furnace Residue
	Anaconda Copper Mining Company	10927	5/41	36,583.20	25,608.24	Car No. NP9743 Red Cake
	Anaconda Copper Mining Company	11277	6/41	36,984.19	25,888.93	Car No. NP30424 Red Cake
	Anaconda Copper Mining Company	11986	8/41	46,100.20	33,670.14	Red Cake
	Anaconda Copper Mining Company	290	10/41	40,205.10	28,143.57	Red Cake
	Anaconda Copper Mining Company	900	1/42	50,397.60	35,278.32	Red Cake
	<u>Total Anaconda Delivered to Uravan</u>			212,270.29	148,589.20	
	E. H. Simms	PC#7936	5/40	1,226.25	502.76	This appears to be vanadium-bearing brick reclaimed from old Rifle Mill and paid as purchased ore.
7/15/42	Louis Ackerman	PC#6915		146.73	58.69	Loma Fusion Fur. Brick
	North Continent Mines	PC#7255	7/8/42 & 8/45/42	14,345.40	7,889.97	Fusion Furnace Residue

* Vanadium Ore Mill Tailings (No V205 Content Available)

PC - Petty Cash Check Number

UNITED STATES VANADIUM CORPORATION, PLANT VP

URAVAN, COLORADO

VANADIUM-BEARING MATERIALS PURCHASED BY ELECTRO METALLURGICAL COMPANYFOR UNITED STATES VANADIUM CORPORATION

<u>Vendor</u>	<u>Material</u>	<u>Date Rec'd.</u>	<u>Car Number</u>	<u>Gross Weight (Lbs)</u>	<u>Pounds V205</u>	<u>Vendor's Inv. Value</u>	<u>Sample and Analysis</u>	<u>Freight</u>	<u>Hauling Cost at Uravan</u>
Phillip Bros., Inc.	Flue Dust	12/39	N&W 120710	34,455	7,376.39	\$ 5,527.04	\$ 28.68	\$ 820.88	\$ 48.14
Phillip Bros., Inc.	Flue Dust	12/39	NYC 131785	39,677	10,113.29	7,281.53	23.34	635.81	36.42
Phillip Bros., Inc.	Flue Dust	12/39	CMST&P 9498	43,814	5,059.94	3,643.19	47.83	714.55	40.21
Phillip Bros., Inc.	Flue Dust	3/40	MILW 18201	45,528	5,944.50	4,280.40	28.70	751.44	95.41
Phillip Bros., Inc.	Flue Dust	4/40	DEAW 45068	51,500	6,269.17	4,513.68	36.20	818.09	57.05
Phillip Bros., Inc.	Flue Dust	5/40	NYC 96503	47,689	6,258.27	4,505.76	36.20	765.70	64.62
Phillip Bros., Inc.	Flue Dust	5/40	NYC 93149	36,474	5,366.84	3,864.24	28.70	575.05	49.43
Phillip Bros., Inc.	Flue Dust	7/40	SP 33315	47,985	8,214.49	5,914.43	26.80	762.29	28.04
Phillip Bros., Inc.	Flue Dust	9/40	LV 5994	43,917	8,194.79	5,898.95	36.13	696.88	21.19
Phillip Bros., Inc.	Flue Dust	10/40	MP 93418	43,193	5,930.35	4,269.86	35.77	692.26	-
Phillip Bros., Inc.	Flue Dust	12/40	C&NW 59306	45,230	15,515.89	11,171.45	36.92	784.38	-
Phillip Bros., Inc.	Flue Dust	12/40	CC&O 8230	45,063	8,080.41	5,936.40	40.59	728.50	-
Phillip Bros., Inc.	Flue Dust	1/41	PRR 123438	41,470	7,917.81	5,700.96	34.11	661.54	-
Total Flue Dust				584,995	100,542.15	\$ 72,507.90	\$ 440.05	\$ 9,404.37	\$ 450.51
Phillip Bros., Inc. *	Flue Dust	5/41	NYC 21178	47,224	-	-	-	737.70	-
Phillip Bros., Inc.	Vanadium Slag	1/40	C&NW 54304	55,285	4,531.67	3,262.80	13.33	880.09	100.60
Phillip Bros., Inc.	Vanadium Slag	5/40	GN 51502	72,419	8,233.31	5,929.42	5.50	1,148.05	172.95
Phillip Bros., Inc.	Vanadium Slag	7/40	PM 85331	35,165	3,430.83	2,470.20	28.25	596.16	-
Phillip Bros., Inc.	Vanadium Slag	8/40	SAL 17979	33,425	2,718.19	1,957.10	6.51	523.05	47.95
Phillip Bros., Inc.	Vanadium Slag	9/40	PRR 573057	48,672	3,957.91	2,849.69	9.49	759.81	69.83
Phillip Bros., Inc.	Vanadium Slag	10/40	NYC 132725	53,285	4,637.38	3,338.91	42.47	828.63	-
Phillip Bros., Inc.	Vanadium Slag	11/40	PRR 573763	42,095	5,080.49	3,657.95	33.56	681.05 Est.	-
Total Vanadium Slag				341,347	32,591.78	\$ 23,466.07	\$ 139.11	\$ 5,416.84	\$ 391.33

* Additional car received from Phillip Bros., Inc. to fulfill deficiency of V205 in Receipts listed above.

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UNITED STATES VANADIUM CORPORATION, PLANT VR

RIFLE, COLORADO

VANADIUM-BEARING MATERIALS PURCHASED (EXCLUDING VANADIUM ORE)

October 1, 1941, to November 11, 1944

<u>Vendor</u>	<u>Purchase Order No.</u>	<u>Date Received</u>	<u>Pounds V205</u>	<u>Value</u>
Anaconda Copper Mining Company	VR-307	3/6/42	43,495.40	30,446.78
Anaconda Copper Mining Company	VR-475	5/7/42	46,776.60	32,743.62
Anaconda Copper Mining Company	VR-673	7/6/42	50,694.60	35,486.22
Anaconda Copper Mining Company	VR-836	9/7/42	45,576.12	31,903.28
Anaconda Copper Mining Company	VR-977	11/10/42	42,196.10	29,537.27
Anaconda Copper Mining Company	VR-1135	1/9/43	52,960.00	37,072.00
Anaconda Copper Mining Company	VR-1285	3/9/43	45,735.60	32,014.92
Anaconda Copper Mining Company	VR-1463	5/7/43	44,631.96	31,242.37
Anaconda Copper Mining Company	VR-1648	7/14/43	53,685.20	37,579.64
Anaconda Copper Mining Company	VR-1908	11/4/43	55,174.77	38,622.34
Anaconda Copper Mining Company	VR-2027	1/7/44	51,237.60	35,866.32
Anaconda Copper Mining Company	VR-2161	3/10/44	46,277.00	32,393.90
Anaconda Copper Mining Company	VR-2278	5/8/44	45,357.10	31,749.97
Anaconda Copper Mining Company	VR-2436	7/10/44	52,074.20	36,451.94
Anaconda Copper Mining Company	VR-2625	9/8/44	49,490.30	34,643.21
Anaconda Copper Mining Company	VR-2809	11/11/44	50,611.50	35,428.05

UNION CARBIDE

✓ *Plaintiffs' Exhibit No. 16*
IN UNITED STATES DISTRICT COURT

LIST OF PURCHASERS OF VARIOUS PRODUCTS

1933 - 1944 INCLUSIVE

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
Ace Foundry, Ltd.									.			.
Adirondack Foundries & Steel, Inc.			
Acton Standard Engineering Co.			
Allioughy Indian Steel Corp.
Alliance Brass and Bronze Co.									.		.	.
Alloy Steel Corporation									.		.	.
Alloy Steel and Metals Company
American Brake Shoe Company		
American Car and Foundry Company									.		.	.
American Cast Iron Pipe Company
American Cyanamid & Chemical Co.	
American Locomotive Company		
American Smelting & Refining Co.							
American Steel Company									.		.	.
American Steel Foundries									.		.	.
American Treadwell Chemical Works					
American Wall & Prospecting Co.		
Aspen Metal, Inc.					
Andrews Steel Company					
Apex Foundry Company					
Arco, Inc.									.		.	.
Arco Corporation									.		.	.
Arco Steel Corporation
Arco Research Foundation								
Arnold Engineering Company					
Atlantic Foundry Company
Atlas Foundry Company						
Atlas Foundry & Machine Co.				
Atlas Steel Casting Company
Auburn Foundry Company							
Aulon Manufacturing Company							
Babcock and Wilcox Tube Company								
Baldwin Locomotive Works								
Barnes Steel Corporation								
Bath-Kline Corporation								
Bethlehem Memorial Institute								

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IN UNITED STATES DISTRICT COURT
PLAINTIFFS' EXHIBIT No. 16

955 - 1944 DALLAS, TEXAS

[illegible]

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LIST OF PURCHASERS OF VANADIUM PRODUCTS
1933 - 1944 INCLUSIVE

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
Rugh S. Cooper								*				
Crucible Steel Casting Company	*	*	*	*	*	*	*	*	*	*		*
Crucible Steel Company of America	*	*							*	*		
Curtiss-Wright Corporation										*		
Cutler-Hammer, Inc.								*				
D & M Machine Works				*				*				*
Dedman Foundry & Machine Company						*				*		
Delco-Remy Division, General Motors Corp.		*				*	*	*	*			
Detroit Alloy Steel Co.								*				
Detroit Gray Iron Foundry Company						*	*	*	*			*
Dipert, Bancroft & Ross Company								*	*			
Henry Diston & Sons								*	*	*		
Dodge Steel Company					*							
Dow Chemical Company								*				
Wilbur E. Driver Company								*	*			
Driver-Harris Company								*	*		*	
Duncan Foundry & Machine Works								*	*			
B. F. Drakenfeld & Company					*			*	*			*
Edgewater Steel Company									*		*	
Eiser and Amend	*		*				*	*				
Electric Steel Casting Company			*									
Empire Ordnance Corporation										*		
Empire Steel Corporation											*	
Enterprise Engine & Foundry Co.										*		
Enterprise Foundry Corporation								*		*		
Erie Forge Company		*							*	*		
Fairchild Aviation, Inc.												*
Fairmount Chemical Company							*			*		
Fairmount Foundry, Inc.								*				
Fansteel Metallurgical Company									*			
Farrell Cheek Steel Company						*	*					*
Ferro Machine and Foundry Co.									*			
Firth-Sterling Steel & Carbide Co.	*	*	*	*	*	*	*	*	*	*	*	*
Florida Machine & Foundry Co.								*	*		*	
Foots Mineral Company									*	*	*	
Ford Motor Company	*	*	*					*	*		*	
Forging and Casting Corporation		*	*	*						*		

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LIST OF PURCHASERS OF AMERICAN PRODUCTS
1933 - 1944 INCLUSIVE

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
General Aircraft Equipment Company												*
General Alloys Company								*				
General Electric Company	*	*			*			*	*	*	*	*
General Iron Works Company												*
General Metals Corporation			*		*			*	*			
Thos. B. Gibbs & Company								*				
Globe Steel Tubes Company								*		*		
Grand Rapids Foundry Company							*					
Granite City Steel Company								*				
Great Lakes Steel Corporation	*											
Gruite Foundries Corporation								*				
Dr. Robert Guent										*		
Chas. Hardy, Inc.								*				
Harnischfeger Corporation					*			*				
Hartford Electric Steel Corp.		*						*				
Haynes Stellite Company	*	*	*	*	*	*	*	*	*	*	*	*
Hi-Alloy Castings Company											*	*
Hinderliter Tool Company											*	*
O. Hummel and Company								*	*			
Hookins Manufacturing Company										*		
Hughes Tool Company					*					*	*	
A. H. Hyndman Company, Inc.										*		
Joshua Hardy Iron Works												*
Indiana Steel Products Company									*	*		
Ingersoll Steel & Disc Division						*	*		*	*		
Island Steel Company						*			*			
Insulation Manufacturing Company												*
International Nickel Company			*			*			*	*		*
Isaacson Iron Works											*	*
Jamestown Malleable Iron Corp.	*											
Jessop Steel Company				*	*	*			*			*
Jones and Laughlin Steel Corp.	*	*			*			*	*		*	
Jealyn Manufacturing & Supply Co.								*	*			

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LIST OF PURCHASERS OF VANADIUM PRODUCTS
1933 - 1944 INCLUSIVE

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
Kaiser Company												*
Kay-Drummer Steel Products Co.								*	*	*		*
K. W. Kellogg Company	*			*		*	*		*		*	
Keystone Steel & Wire Company							*					
Kilby Steel Company				*				*	*	*		
Kinsaid-Osburn Electric Steel Co.												*
Knoxville Iron Company									*			
Koppers Company			*						*			
Krusal Laboratories	*	*									*	*
Leakade Steeler Company										*		
Lafayette Electric Steel Company		*	*	*	*	*	*	*	*	*	*	*
L. Levin & Sons					*						*	
Lebanon Steel Foundry	*	*	*	*	*	*	*	*	*	*		
Lectromalt Steel Castings Company							*		*			
Lectromalt Company of Georgia									*	*		
Lincoln Electric Company	*			*	*	*	*	*	*	*	*	*
Lindsay Light & Chemical Company			*	*	*	*	*	*				
Lish-Belt Company				*	*	*	*					*
L. E. Lockyer & Schaffrin Company					*							
Locomotive Finished Materials Co.									*			
Los Angeles Steel Castings Company										*		*
Lehman Steel Company												
Mapes Bros.							*					*
Malloy Company				*					*			*
McClintock Iron Works Company												*
P. E. Malloy Company			*					*	*			*
Marion Steam Shovel Company	*			*	*	*	*	*	*			*
Marquette Manufacturing Company									*			*
Marshall Steel Casting Company									*			*
Maynard Electric Steel Castings Co.		*		*	*				*	*		*
Meets Machine Company											*	*
Metal & Thermal Corporation									*	*		
Metal Products Manufacturing Co.									*	*		
Metalloy Corporation									*	*		
Michigan Steel Castings Company							*		*			

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LIST OF PURCHASERS OF VARIOUS PRODUCTS
1938 - 1944 INCLUSIVE

	1938	1939	1940	1941	1942	1943	1944
Midvale Company					•	•	
Miller Foundry Company		•	•				
Millwaukee Steel Foundry Company	•	•	•	•			
Monroeville Foundry & Machine Company	•						
Monroe Steel Castings Company					•	•	•
Monroeville Chemical Company			•	•	•	•	•
Motor & Machinery Castings Company				•			
Mountain State Steel Foundries			•				
National Aniline & Chemical Company	•	•	•	•	•		
National Art Bronze Works				•			
National-Erie Company	•	•			•		
National Malleable & Steel Castings Co.			•	•	•		
National Products & Refining Company						•	
National Supply Company			•	•	•	•	
National Traffic Guard Company					•		
Nobellite Steel Steel Company						•	
Nogara Falls Smelting & Refining Co.							•
Nottingham Granville Steel Company				•			
Ohio Steel Foundry Company	•	•	•			•	•
Oklahoma Steel Castings Co.	•		•				
Oliver Farm Equipment Company			•				
Omaha Steel Works				•	•		
Osgood Company		•	•	•			
Otis Elevator Company				•	•		
Oswald Acetylene Company					•		
Pacific Car & Foundry Company					•	•	
Pacific Metals Company				•			
Parkeburg Big & Small Company					•		
Patton Bros Supply Company					•		
Pennsylvania Electric Steel Castings Co.	•	•			•		
Perrin Malleable Castings Co.				•			
Perfect Circle Company		•		•			
Pottitown Malleable Corporation						•	•
C. E. Phillips & Company				•			

LIST OF PURCHASERS OF VANADIUM PRODUCTS

1945 - FIRST 7 MONTHS '49

	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>7 Months</u> <u>1949</u>
Acme Foundry Co.					.
Actarc, Inc.	.	.			
Adirondack Pipes & Stl. Inc.	.	.	.		
Aetna Standard Engineering Co.			.	.	
Allaghery Ludlum Stl. Corp.
Alliance Brass & Bronze Co.			.		.
Alloy Stl. & Metals Co.			.		
Alloy Stl. Products	.				
American Brake Shoe Co.	.				
American Cast Iron Pipe Co.		.	.		
American Chain & Cable Co.			.		
American Cyanamid & Chem. Co.		.		.	.
American Elec. Metal Corp.		.	.		
American Fdry. & Cstgs.			.		
American Optical Co.				.	
American Pipe & Stl. Corp.	.				
American Radiator & Std.	.				
American Wheelabrator & Equip.					.
Aspeco Metal Inc.
Apex Foundry Co.	.			.	
Arcos, Inc.	.				.
Armour Research Foundation	.	.			.
Arnold Engineering Co.		.		.	
Artisan Metal Prod. Inc.			.	.	
Atlas Stl. Casting Co.		.			
-Atlas Stl. Ltd.		.	.		
Auburn Fdry. Co.	.		.		
Austenal Labs.			.	.	
Axelsson Mfg. Co.				.	
Babcock & Wilcox Tube Co.	.		.		.
Barius Steel Corp.	.		.		.
Battelle Memorial Institute
Bell Telephone Labs.
Belmont Smelting & Refining Wks.
Beacon Tool Co.					.
James H. Beane Fdry.					.

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LIST OF PURCHASERS OF VAMANTU PRODUCTS
1932 - 1944 INCLUSIVE

	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
Star Foundry Company							.						
Stover Foundry Company							.	.					
Sterling Steel Foundry Company							.		.	.			
Stover Manufacturing & Engine Co.									.				
Sumner Iron Works			.										
Superior Steel & Malleable Castings Co.	.	.	.										
Sylvania Electric Products Company											.		
Henry S. Tenny													.
Taylor-Sherten Iron & Steel Co.		
Andrew Terry Company			
Texas Electric Steel Casting Company							.	.		.			
Texas Steel Company							.	.					
Thompson Products, Inc.													.
Tisham Roller Bearing Company
Titanium Alloy Manufacturing Co.				
San Yuen & Company, Inc.					.								.
Trendall Engineering Company	
Triford-Brownson & Fishel, Inc.													.
Tucson Metals & Manufacturing Co.												.	.
Van Wadding, Inc.		
United Engineering & Foundry Co.		
U. S. Government
U. S. Pipe & Foundry Company	
U. S. Steel Corporation
Universal-Cyclops Steel Corporation				
Utility Electric Steel Foundry						
Valley Iron Works							.						
Valley Steel Castings Company		
Vanadium-Alloys Steel Company				
Vanadium Corporation of America
Vitre Manufacturing Company				
Vulcan Crucible Steel Company
Vulcan Iron Works		

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LIST OF PURCHASERS OF VANADIUM PRODUCTS
1933 - 1944 INCLUSIVE

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
Walleck Foundry Company							*					
J. P. Ward Foundries, Inc.						*						
Warman Steel Casting Company		*	*	*	*			*				*
Washburn Wire Company									*			
Washington Iron Works										*		
Weatherly Steel Castings Co.									*			
Wehr Steel Company			*	*			*				*	*
West Steel Castings Company	*	*	*	*	*	*	*	*	*	*	*	*
Welding Equipment & Supply Co.					*	*	*	*	*			*
Western Electric Company				*	*	*	*	*	*		*	*
Western Foundry Sand Company								*				
Western Steel Casting Company			*	*	*							
Westinghouse Electric & Mfg. Co.	*					*		*			*	
Westlectric Castings Company									*			*
Weston Electrical Instrument Company	*											
Wheland Company									*			
Whip-Mix Corporation									*			
Whipple & Choate Company					*	*	*	*				
Whitehead Metal Products Company		*			*	*	*	*				
H. A. Wilson & Company		*						*				
Wisconsin Alloys Company							*	*	*			
Alan Wood Steel Company			*	*					*	*		
Worth Steel Company									*	*		
Isenia Foundry & Machine Co.	*											
Youngstown Alloy Casting Corp.				*		*	*	*	*			
Youngstown Foundry & Machine Co.	*	*	*	*	*	*	*	*	*			

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LIST OF PURCHASERS OF VANADIUM PRODUCTS
1933 - 1944 INCLUSIVE

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
Pittsburgh Metallurgical Company									*			
Pittsburgh Steel Company										*		
Pittsburgh Steel Foundry Corp.			*				*					
Plainville Casting Company											*	
Pittsburgh Coke & Iron Company												
R.C.A. Manufacturing Company			*					*				*
Rankin Manufacturing Company										*		
Reichhold Chemical Company											*	
Reid-Avery Company								*				
Reliable Foundry Company								*				
Republic Steel Corporation	*	*	*	*	*	*	*	*	*	*	*	*
Reynolds Metals Company							*			*		
John A. Roebbing's Sons Company									*			
Ross-McCann Foundries									*			
Joseph Ross									*			
Rotary Electric Steel Company									*	*		
Stainless Iron & Steel Corp.					*	*						
Saginaw Malleable Iron Div.-General Motors Corp.		*										*
Seovill Manufacturing Company		*		*	*							
Seullin Steel Company		*	*	*	*		*		*	*		
Sealed Power Corporation						*		*	*	*		
Service Foundry, Inc.								*	*	*		*
Sharon Steel Corporation								*	*	*	*	*
Sheppard Plate & Machine Works								*	*	*		*
Sinclair Saw and Steel Company										*		
Sivyer Steel Casting Company	*		*									*
Skagit Steel & Iron Works									*	*	*	*
A. O. Smith Corporation			*					*	*	*	*	*
Solvay Process Company								*	*	*		*
Standard Alloy Company								*	*	*		*
Standard Brake Shoe & Foundry Co.								*	*	*		*
Standard Foundry Company								*	*	*		*
Standard Oil Company of California							*	*			*	*
Standard Stoker Company	*	*	*				*	*			*	*
Standard Ultramarine Company										*		

LIST OF PURCHASERS OF VANADIUM PRODUCTS

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	<u>1945 - FIRST 7 MONTHS '49</u>					<u>7 Months</u>
	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	
Bendix Aviation Corp.	•					
Berkley Machine Wks. & Mfy. Co.	•		•			
Cabot Shops, Inc.	•					
Calif. Inst. Technology						•
Calif. Precision Cstgs.				•		•
Canadian Brake Shoes & Mfy. Co. Ltd.		•				
Canadian Car & Mfy. Co. Ltd.		•				
Carbide & Carbon Chem. Corp.				•		
Carborundum Co.	•		•			
Carondelet Mfy. Co.						•
Carpenter Stl. Co.	•	•	•	•		•
Central Iron & Stl. Co.		•	•			
Champion Rivet Co.	•		•			
Chapman Valve Mfg. Co.	•	•	•	•		•
Ceramic & Color Chemical Mfg.				•		
Charlotte Chemicals Lab.				•		
S. Cheney & Son		•	•	•		
Chicago Stl. & Wire Co.				•		
Chrysler Corp.				•		
Cincinnati Milling Machine Co.				•		
Columbia Stl. Cstgs. Co.				•		
Columbia Tool Stl. Co.	•	•	•	•		•
Continental Machines, Inc.						•
Continental Ore Co.	•	•				
Cooper Alloy Mfy. Co.	•	•	•	•		•
Centrifugal Casting Co.		•				
Crucible Stl. Co. of America				•		•
Curtiss-Wright Corp.	•					
D & M Machine Works		•				
Devcon Chem. Corp.				•		•
Dayton Malleable Iron Co.	•	•				
Detroit Gray Iron Mfy. Co.		•				
Dibert, Bancroft & Ross Co.	•					
S. F. Drakenfeld & Co.				•		•
Duralloy Co.		•	•	•		
Du Pont de Nemours & Co.		•		•		•
Duriron Co.	•	•				

LIST OF PURCHASERS OF VANADIUM PRODUCTS

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1945 - FIRST 7 MONTHS '45

	<u>1-45</u>	<u>2-45</u>	<u>3-45</u>	<u>4-45</u>	<u>7 Months</u> <u>1-45</u>
Edgewater Stl. Co.		"			
Ednas Precision Casting Corp.	"			"	"
Eimer & Amer.				"	
Ekstrand & Thuland Inc.					
Fairmount Chemical Co.			"	"	
Ferro Enamel Corp.		"		"	
Firth-Sterling Stl. & Carbide Co.	"	"	"	"	"
Florida Machine & Foundry Co.	"	"	"	"	"
Foots Mineral Co.	"		"	"	"
					"
Gardner-Denver Co.	"				
General Aircraft Equip. Co.	"				
General Alloys Co.	"	"		"	"
General Electric Co.	"	"	"	"	"
General Metals Corp.	"		"	"	
General Motors	"	"	"	"	
Glover Machine Works			"	"	
Gorham Tool Co.				"	
Goyne Steam Pump Co.				"	
		"			"
C. Paul Hagenlocher					"
Hamburg Plow Co.		"	"	"	"
Manford Foundry Co.		"	"	"	"
Harnischfeger Corp.		"	"	"	"
Marshaw Chemical Co.		"			
Hartford Electric Stl. Corp.		"		"	
Hayden Chemical Corp.		"	"	"	"
Haynes Stellite Co. (Allied)	"	"	"	"	"
Heppenstall Co.	"			"	
Hetherington & Berner					"
Highland Prints Inc.	"				
E. F. Hirsch, Inc.		"	"	"	
Hughes Tool Co.			"	"	
Hydrocarbon Res. Inc.			"		

LIST OF PURCHASERS OF VANADIUM PRODUCT.

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LIST OF PURCHASERS OF VANADIUM PRODUCTS

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	<u>1945 - FIRST 7 MONTHS 1949</u>				<u>7 Months</u>
	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>
National Aniline & Chem. Co.				•	
National Bronze & Aluminum Fdry. Co.				•	•
National Carbon Co.				•	•
National Cash Register				•	•
National Malleable & Stl. Casts. Co.	•		•	•	•
National Supply Co.				•	
Norfolk & Western Railway Co.					
Olympic Stl. Wks.		•	•	•	
Omaha Stl. Wks.	•	•			
Oregon Stl. Fdry. Co.				•	
E. F. Owens			•		
Pacific Metals Co.					
Pacific States Stl. Corp.	•			•	
Pacific Stl. Casts. Co.		•			
Pennsylvania Elec. Stl. Casts. Co.	•				
E. A. Quirin Machine Shop & Fdry.					•
Reid-Avery Co.	•			•	
Reilly Tar & Chem. Corp.					
Reliance Regulator Corp.	•	•	•	•	•
Republic Stl. Corp.	•				
Rockwell Mfg. Co.	•	•			
Rustless Iron & Stl. Corp.					
St. Lawrence Alloys Inc.	•		•	•	•
Sealed Power Corp.	•		•	•	
Sharon Stl. Corp.	•				
Sheppard Plate & Machine Wks.	•			•	
A. O. Smith Corp.	•	•			
Solar Aircraft Co.	•	•			
Sorel Stl. Pipes. Ltd.				•	
Standard Brake Shoe & Fdry. Co.			•		
Standard Oil Co. New Jersey		•			
Standard Oil Development Co.		•	•	•	•
Standard Stoker Co.	•	•	•	•	•

LIST OF PURCHASERS OF VANADIUM PRODUCTS

Page 6

1945 - FIRST 7 MONTHS '49

	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>7 Months 1949</u>
Standard Ultramarine Co.	•	•			
Stauffer Chemical Co.				•	
Sterling Alloys Co.		•			
Strong Stl. Mfry. Co.		•			
Sylvania Elec. Products Co.			• •		
San Francisco Sulphur Co.				•	
David Taylor Co.			•		
Tishen Roller Bearing Co.	•	•	•	•	•
Tri-State Mfrs. Inc.					•
Trussell Mfry Co.					•
Unexcelled Chem. Co., Inc.		•			
United Engineering & Mfry. Co.	•				
U. S. Aluminum Co.			•		
U. S. Finishing Co.				•	
U. S. Government	•		•		•
U. S. Pipe & Foundry Co.		•			
U. S. Steel Corp.	•	•	•	•	•
Universal-Cyclops Steel Corp.	•	•	•	•	
Utility Elec. Stl. Mfry.		•			
Vanadium-Alloys Stl. Co.	•	•	•	•	•
Vanadium Corp. of America				•	
Vitro Mfg. Co.	•			•	•
Vulcan Crucible Stl. Co.	•	•	•	•	
Vulcan Iron Wks. Ltd.		•			
Vulcan Mfry. Co.		•			
Vulcan Stl. Mfry.					•
Wall Colmonoy Corp.	•				
Dr. Eugene Weimer			•		
Warman Stl. Cste. Co.	•				
Washington Iron Wks.	•				
Webster Mfg. Co.			•		
Wehr Stl. Co.					•
Welding Equipment & Supply Co.	•	•	•	•	

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LIST OF PURCHASERS OF VANADIUM PRODUCTS

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1945 -
 1945 - FIRST 7 MONTHS '49

	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>7 Months</u> <u>1949</u>
Welland Elec. Stil. Pdry.		*		*	
West Stil. Cstgs. Co.			*	*	
Westvaco Chem.				*	
Western Alloyed Stil. Cstg. Co.			*	*	
Western Elec. Cstg. Co.			*	*	
Western Electric Co.	*	*	*	*	*
Western Industrial Supply			*	*	
Western Stil. Cstg. Co.	*	*	*	*	*
Westlectric Cstgs. Co.			*	*	*
Whitman Co.	*				
Wield Mold		*			
H. A. Wilson & Co.	*				
Winchester Repeating Arms Co.	*				
University of Wisconsin					*
Youngstown Alloy Cstg. Corp.			*		
Tulcan Crucible Stil. Co.			*		

PRD:lc
 10/8/56

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IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 17

✓ *Plaintiffs Exhibit No. 17*Vanadium Corporation of America

Sales of Vanadium Ore, Flue Dust, Vanadic Acid (Vanadium Pentoxide) and Ferro Vanadium and Price Ranges.

YEAR 1933

Domestic

<u>Customer</u>	<u>Material</u>
American Cyanamid & Chem. Co.	VPent
Allegheny Steel Co.	FeV
Alloy Cast. Steel Co.	"
American Arc Welders	"
American Steel Foundries	"
Andrews Steel Co.	"
Apex Foundry Co.	"
Armeson Foundry Co.	"
Banner Iron Works	"
Batavia Foundry Co.	"
Bell Telephone Lab.	"
Bethlehem Steel Co.	"
Birney Castings Co.	"
Blaw Knox Co.	"
Bonney-Floyd Co.	"
Braeburn Alloy Steel Corp.	"
Brighton Elec. Steel Cast. Co.	"
Buffalo Fdry & Mach. Co.	"
Colonial Steel Co.	"
Crucible Steel Cast. Co.	"
Crucible Steel Co. of America	"
Detroit Alloy Steel Co.	"
Henry Dieston & Sons	"
Duriron Co.	"
Electro Alloys	"
Electrocast Steel Fdry Co.	"
Electromet Co.	AmMVan
Empire Steel Cast. Co.	FeV
Erie Forge Co.	"
Falk Corp.	"
Firth Sterling Steel Co.	"
Ford Motor Co.	"
Forging and Cast. Corp.	"
Fort Pitt Steel Cast. Co.	"
General Electric Co.	"
General Chemical Co.	VPent.
Grasselli Chemical Co.	"
General Steel Cast. Co.	FeV
Glover Machine Works	"
Great Lakes Steel Corp.	"
Gulf States Steel Co.	"
Halcomb Steel Co.	"
Harshaw Chem. Co.	VPent
Harrisburg Pipe and Pipe Bend.	FeV
Hartford Electric Steel Corp.	"
Heppenstall Co.	"
Industrial Steel Cast. Co.	"
Ingersoll Steel & Disc. Co.	"
International Harvester Co.	"

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Domestic

1933

<u>Customer</u>	<u>Material</u>
International Nickel Co.	FeV
Jesseop Steel Co.	VPent
Jones & Laughlin Steel Corp.	FeV
Kinite Corp.	"
Krebs Pigment & Color Corp.	VPent
Lafrore Elec. Steel Co.	FeV
Lebanon Steel Foundry	"
Lewis Foundry & Machine Co.	"
Locomotive Fin. Matl. Co.	"
Ludlum Steel Co.	"
Lukens Steel Co.	"
Marion Steam Shovel Co.	"
Maynard Elec. Steel Cast. Co.	"
Michiana Products Corp.	"
Michigan Steel Cast. Co.	"
Midvale Co.	"
Minneapolis Elec. Steel Cast. Co.	"
Monroe Steel Cast. Co.	"
Monsanto Chemical Co.	VPent
National Art Bronze Works	FeV
National Forge & Ordnance Co.	"
Ohio Steel Foundry Co.	"
William M. Orr Co.	"
Otis Steel Co.	"
Parker Pen Co.	AmhVVan
Pittsburgh Crucible Steel Co.	FeV
Pitts. Steel Fdry Corp.	"
Quaker City Fdry	"
Reading Co.	"
Reed Fdry & Mach. Co.	"
Republic Steel Corp.	"
Ross Meehan Foundries	"
Simonds Saw & Steel Co.	"
E. W. Simpson	"
Southern Mll. Iron Co.	"
Standard Brake Shoe & Fdry Co.	"
Standard Steel Car Co.	"
Steward Steel Works Co.	"
Sterling Steel Fdry Co.	"
Symington Co.	"
Timken Roller Bearing Co.	"
Union Sprg. & Mfg. Co.	"
Union Steel Cast. Co.	"
United Eng. & Fdry Co.	"
Universal Steel Co.	"
Vanadium Alloys Steel Co.	"
Vulcan Crucible Steel Co.	"
Washburn Wire Co.	"
Wehr Steel Co.	"
Westinghouse Elec. & Mfg. Co.	"
West Mich. Steel Foundries	"
Western Elec. Co.	"
Youngstown Sheet & Tube Co.	"

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- 1933 -

CANADIAN

<u>Customer</u>	<u>Material</u>
Dominion Foundries & Steel Ltd.	FeV

1933 Domestic and Canadian Price Ranges

FeVCH	\$2.60 per lb. Ctd. V
FeVCru	2.70 " "
FeVPri	2.80 " "
VPent	1.05 to 1.15 per lb. Ctd. V205
Ann.M.Van.	1.90 per pound

Prices the same to all customers for similar quantities, sizes on contract and spot bases. Special grinding and quality extras not indicated in above standard prices.

VANADIUM CORPORATION of AMERICA

Sales of Vanadium Ore, Flue Dust, Vanadic Acid
(Vanadium Pentoxide) & Ferro Vanadium

and Price Ranges

Domestic

Year - 1934

<u>Customer</u>	<u>Material</u>
Alloy Cast Steel Co.	Fe V
American Cast Iron Pipe Co.	"
American Steel Foundries	"
Andrews Steel Co.	"
Arcade Malleable Iron Co.	"
Armstrong Foundry Co.	"
Babcock & Wilcox Co.	"
Bell Telephone Lab.	"
Bethlehem Steel Co.	"
Birney Castings Co.	"
Birdsboro Steel Foundry & Mach. Co.	"
Bonney-Floyd Co.	"
Braeburn Alloy Steel Corp.	"
Brighton Electric Steel Cstg. Co.	"
Buckeye Steel Cstg. Co.	"
Burnside Steel Foundry Co.	"
A. M. Byers Co.	"
Cincinnati Milling Machine Co.	"
Colonial Steel Co.	"
Crucible Steel Casting Co.	"
Crucible Steel Co. of America	"
Damascus Steel Casting Co.	"
Detroit Alloy Steel Co.	"
Henry Diaston & Son	"
E. I. DuPont	AmVVan
Duriron Co.	FeV
Eastern Steel Casting Co.	"
Eastman Kodak Co.	AmVVan
Electrocast Steel Foundry Co.	FeV
Empire Steel Castings Co.	"
Eric Forge & Steel Co.	"
Falk Corp.	"
Foots Mineral Co.	AmVVan
Ford Motor Co.	FeV
Forging and Casting Corp.	"
Fort Pitt Steel Casting Co.	"
Foster Wheeler Corp.	"
General Chemical Co.	VPent
General Electric Co.	FeV
General Steel Cstgs. Corp.	"

[fol. 74]

2.

Domestic

Year - 1934

<u>Customer</u>	<u>Material</u>
Gleaver Machine Works	FeV
Gorham Tool Co.	"
Gould Coupler Co.	"
Great Lakes Steel Corp.	"
Gulf States Steel Co.	"
Charles Hardy Inc.	"
Harrisburg Pipe & Pipe Bending Co.	"
Hartford Electric Steel Corp.	VPent
Marshaw Chemical Co.	FeV
Heppenstall Co.	"
Hunt Spiller Mfg. Co.	"
Industrial Steel Casting Co.	"
Ingersoll Steel & Vise Co.	"
Jessop Steel Co.	VPent
Jessop Steel Co.	FeV
Jones & Laughlin Steel Corp.	"
Kinite Corp.	"
Latrobe Elec. Steel Co.	"
Lebanon Steel Foundry	"
Lewis Foundry & Machine Co.	"
Locomotive Finished Matl. Co.	"
Ludlum Steel Co.	"
Lukens Steel Co.	"
Machined Steel Ctg. Co.	"
Marion Steam Shovel Co.	"
Marshall Car Wheel & Foundry Co.	"
Massillon Steel Ctg. Co.	"
Maynard Electric Steel Ctg.	"
Michigan Valve & Foundry Co.	"
Midvale Co.	"
Monroe Steel Ctg. Co.	VPent
Monsanto Chemical Co.	FeV
National Alloy Steel Co.	"
National Art Bronze Works Co.	"
National Forge & Ordnance Co.	"
National Mill & Steel Ctg. Co.	"
Ohio Steel Foundry Co.	"
Otis Steel Co.	"
Parker Pen Co.	AmnWan
Pittsburgh Steel Foundry Corp.	FeV
Reading Co.	"
Reliance Steel Castings Co.	"
Republic Steel Corp.	"

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Domestic

Year - 1934

<u>Customer</u>	<u>Material</u>
Benisto-Lay Co.	PoV
Bess-Moehan Foundries	"
Brookbank Steel Castings Co.	"
Minneka Saw & Steel Co.	"
Southern Malleable Iron Co.	"
Standard Brake Shoe & Fly Co.	"
Standard Steel Works Co.	"
Sterling Steel Foundry Co.	"
Springton Co.	"
Timken Roller Bearing Co.	"
Union Steel Casting Co.	"
United Engineering & Pipe Co.	"
United States Steel Corp.	"
University of Chicago	"
Universal Steel Co.	"
Vanadium-Alloy Steel Co.	"
Vanadium-Alloy Steel Co.	VPunt
Vulcan Crucible Steel Co.	PoV
Vulcan Iron Works	"
Victor Chemical Works	VPunt
Washburn Wire Co.	PoV
Wehr Steel Co.	"
West Michigan Steel Pipe Co.	"
Western Electric Co.	"
Youngstown Alloy Castings Co.	"
Youngstown Sheet & Tube Co.	"

Canadian

Dominion Foundry & Steel Ltd.

PoV

1934 Domestic and Canadian Price Range

PoVCH	\$2.70 per lb. std. V
PoVCu	2.80 per lb. std. V
PoVPri	2.90 per lb. std. V
VPunt	1.10 to 1.30 per lb. std. V ₂ O ₅
AmNiVun	2.00 per lb.
Wmetal 90%	4.50 to 5.00 per lb.
Wmetal 95%	.40 to .50 per gram

Prices the same to all customers for similar quantities, since --
on contract and spot bases. Special grinding and quality extras
not indicated in above standard prices.

[fol. 76]

VANADIUM CORPORATION of AMERICA

Sales of Vanadium Ore, Flue Dust, Vanadic Acid
(Vanadium Pentoxide) & Ferro Vanadium

and Price Ranges

Domestic

Year - 1935

<u>Customer</u>	<u>Material</u>
Allegheny Steel Co.	FeV
Alloys Steel & Metals Co.	"
Aluminum Company of America	VMetal
American Cyanamid & Chem. Co.	V Pent
American Smelting & Ref. Co.	V Metal
American Steel Fdrys.	FeV
American Grade Publishing Co.	VPent
Andrews Steel Co.	FeV
Josiah Anstice & Co.	"
Arnold Print Mks.	AnnMVan
Atlas Powder Co.	VPent
Baltimore Copper Smelting	"
Jno. D. Reinert	AnnMVan
bell Telephone Co.	FeV
berg Chemical Co.	AnnMVan
Berge, J. & H.	VMetal
bethlehem Steel Co.	FeV
Bonney Floyd Co.	FeV
braeburn Alloy Steel Co.	FeV
Braun Corp.	AnnMVan
brighton Elec. Steel Ctg. Co.	FeV
buckeye Steel Ctg. Co.	"
Buffalo Apparatus Co.	AnnMVan
burnside Steel Fdry. Co.	FeV
Burrell Tech. Supply Co.	VPent
Carbic Color & Chem. Co.	AnnMVan
W. A. Case & Son Mfg. Co.	VPent
Century Chem. Co.	AnnMVan
Ceramic Color & Chem. Co.	VPent
City Chem. Corps.	"
Clark Equipment Co.	FeV
Climax Molybdenum Co.	"
Coleman & bell Co.	VPent
Colonial Steel Co.	FeV
Coloray Corp.	AnnMVan
Corning Glass Mks.	VPent
Crucible Steel Ctg. Co.	FeV
Crucible Steel Co. of America	"
Detroit Alloy Steel Co.	"
Deaston & Sons, Inc., Henry	"
Driver Harris Co.	"
E. I. DuPont de Nemours	AnnMVan
Dupont Rayon Co.	"
Eastman Kodak Co.	"

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2.

Domestic

Year - 1935

<u>Customer</u>	<u>Material</u>
Electrocast Steel Fdry Co.	FeV
Empire Steel Cstgs. Co.	"
Erie Forge Co.	"
Falk Corp.	"
Fansteel Prod. Co.	VMetal
Fashion Screen Prtg.	AmnWan
Fisher Scientific Co.	VPent
Fiske Brick & Granule Co.	"
Foots Mineral Co.	FeV
Ford Motor Co.	"
Forgings & Castings Corp.	"
Fort Pitt Steel Cstg. Co.	"
General Alloys Co.	VPent
General Ceramics Co.	"
General Chemical Co.	AmnWan
General Dyestuff Corp.	FeV
General Elec. Co.	"
General Steel Cstg. Corp.	"
Glover Machine Mks.	AmnWan
Jno. Graham & Co.	VPent
Grasselli Chem. Co.	FeV
Great Lakes Steel Corp.	"
Gulf States Steel Co.	VPent
Harshaw Chem. Co.	FeV
Harrisburg Steel Corp.	"
Harrison Steel Cstg. Co.	"
Hartford Elec. Steel Co.	AmnWan
Hartsville Print & Dye Mks.	FeV
Heppenstall Co.	VMetal
H.V. Hoffstadt	VPent
O. Hommel Co.	AmnWan
Howe & French, Inc.	"
Hudson Fur Dyeing, Inc.	FeV
Industrial Steel Cstg. Co.	"
Ingersoll Steel & Disc. Co.	AmnWan
Interborough Chem. Co.	FeV
Jessop Steel Co.	VPent
Jessop Steel Co.	FeV
Johnson Co., Adolph	"
Jones & Laughlin Steel Corp.	AmnWan
Kerr Co., Frank W.	FeV
Kinite Corp.	AmnWan
Landers Frary & Clark	FeV
Latrobe Elec. Steel Co.	"
Lebanon Steel Fdry.	AmnWan
Lennig & Co., Inc., Chas.	VPent
Leyes, C.J.	

[fol. 78]

Domestic

Year - 1935

3.

<u>Customer</u>	<u>Material</u>
Locomotive Fin. Mat. Co.	FeV
Ludlum Steel Co.	"
Lukens Steel Co.	"
Machined Steel Casting Co.	"
Mackintosh Hamphill Co.	"
Mallory & Co., P.R.	VPent
Marion Steam Shovel Co.	FeV
Massillon Steel Cstgs. Co.	"
Waynard elec. Steel Cstg. Co.	"
McKay, A. D.	VMetal
Merts Co., L. Carlton	VPent
Michigan State College	FeV
Michiana Products Corp.	"
Midvale Co.	"
Molybdenum Corp. of America	VPent
Monroe Steel Cstgs. Co.	FeV
Nat. Analine & Chem. Co.	VPent
Nat. Art dronse Co.	FeV
Nat. Dyeing & Printing Co.	AmNiVan
Nat. Forge & Ordnance Co.	FeV
Nat. Moll. & Steel Castg. Co.	"
New Jersey Zinc Co.	VMetal
Ohio Steel Fdry Co.	FeV
Palb Meyers, Inc.	VPent
Parker Pen Co.	AmNiVan
Penn. Coal Products Co.	VPent
Perennial Dye & Print Mks	AmNiVan
Pettibone Mulliken Co.	FeV
Pitts.Plate Glass Co.	VPent
Pitts.Steel Fdry. Corp.	FeV
Pond Lily Corp.	AmNiVan
Pratt & Latchworth	FeV
Queen Dyeing Co.	AmNiVan
Hamapo Finishing Corp.	AmNiVan
Reliable Ink & Stationery Co.	AmNiVan
Reliable Paste & Ink Co.	AmNiVan
Reliance Steel Cstgs.Co.	FeV
Republic Steel Corp.	"
Roebblings Sons Co., John A.	"
Ross Meeham Fdries	"
St. Francis College	VPent
Sargent Co., L.H.	"
Schaar Co.	AmNiVan
Schade Paper Laboratory	"
Scientific Glass Apparatus Co.	"
" " " "	VPent

[fol. 79]

Domestic

Year - 1935

<u>Customer</u>	<u>Material</u>
Shepherd Chemical Co.	AmhVan
Simons Saw & Steel Co.	FeV
Sirtex Printing Co.	AmhVan
Smith Corp., A.O.	VPent
Solvay Process Co.	AmhVan
Southern Malleable Iron Co.	FeV
Special Chemical Corp.	VPent
Std. Steel Works Co.	FeV
Sterling Steel Castg Co.	"
Sterling Steel Fdry. Co.	"
Stifel & Son, J.L.	AmhVan
Stone, Chas. H.	"
Stoody Co.	FeV
Symington Co.	"
Tinken Moller Bearing Co.	"
Tubise Chatillon Corp.	AmhVan
Una Welding, Inc.	FeV
Union Oil Co. of Calif.	AmhVan
Union Steel Castg. Co.	FeV
United Eng. & Fdry Co.	"
U.S. Steel Corp.	"
Univ. of Pitts.	VPent
Universal Steel Co.	FeV
Vanadium Alloy Steel Co.	"
Victor Chem. Works	VPent
Vulcan Crucible Steel Co.	FeV
Waldrick Co.	AmhVan
Walker & Co., Inc., G.T.	"
Wallwork Fdry. Co.	FeV
Warner Chem. Co.	VPent
Washburn Wire Co.	FeV
Westinghouse Air Brake Co.	"
West Mich. Steel Fdry Co.	"
Westvaco Chlorine Prod. Co.	VPent
Will Corp.	AmhVan
Wollen Chem. & Supply Co.	"
Worth Steel Co.	FeV
Worthington Pump & Machy Co.	"
Dominion Fries & Steel, Ltd.	"

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Domestic

Year - 1935

5.

1935 Domestic and Canadian Price Ranges

Fe. VON	\$2.70 per lb. Ctd. V
Fe. V Cru.	2.80 " "
Fe. V Pri.	2.90 " "
V. Pent.	1.10 per lb. Ctd V205 to 1.35 per lb Matl
Ann. M. Van.	1.90 to 2.25 per pound
V. Metal 90%	4.50 to 5.00 " "
" 95%	.40 to .45 " gram

Prices the same to all customers for similar quantities, sizes - on contract and spot basis. Special grinding and quality extras not indicated in above standard prices.

[fol. 81]

VANADIUM CORPORATION OF AMERICA

Sales of Vanadium Ore, Flue Dust, Vanadic Acid (Vanadium Pentoxide), Ferro Vanadium and Price Ranges

YEAR - 1936

DOMESTIC

CUSTOMER	MATERIAL
Ach, Clifford L.	Van P
Agricultural Experiment Station	Amo Van
Alan Wood Steel Co.	Fe V
Allied Steel Catgs. Co.	Fe V
Am. Art Textile Prtg. Corp.	Amo Van
Am. Cer & Fary. Co.	Fe V
Am. Cyanamid & Chem. Co.	Amo Van
	Sod Van
	Van P
	Fe V
Am. Locomotive Co.	Fe V
Am. Manganese Steel Co.	Fe V
Am. Steel Faries.	Fe V
Andrews Steel Co.	Fe V
Apex Fdry. Co.	Fe V
Arnold Print Works	Amo Van
Atlas Fdry. Co.	Fe V
Atlas Steel Catg. Co.	Fe V
Babcock & Wilcox Co.	Fe V
Bakulich, M. A.	Van P
Beck, Koller & Co.	Van P
Bell Telephone Lab.	Fe B
Beltramo, Inc., F. J.	Amo Van
Berg Chemical Co.	Amo Van
Bethlehem Steel Co.	Fe V
Birdsboro Steel Fdry. & Mach. Co.	Fe V
Blaw Knox Co.	Van Metal
Boericks & Runyan	Van Metal
Bonney Floyd Co.	Fe V
Braeburn Alloy Steel Co.	Fe V
Braun Corp.	Amo Van
Brighton Elec. Steel Catg. Co.	Fe V
Burnside Steel Fdry. Co.	Fe V
Calumet Steel Catgs. Corp.	Fe V
Carbic Color & Chem. Co.	Amo Van
Carondelet Fdry. Co.	Fe V
Central Scientific Co.	Sod Van
Central Iron Fdry. Co.	Fe V
Champion Spark Plug Co.	Van P
Chicago Steel & Wire	Fe V
Clera Equipment Co.	Fe V
Climax Molybdenum Corp.	Fe V

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CUSTOMER	MATERIAL
Colonial Steel Co.	Fe V
Consolidated Drystuff Corp.	Ann Van
Continental Roll & Steel Fdry. Co.	Fe V
Crucible Steel Casting Co.	Fe V
Lansdowne, Pa.	
Crucible Steel Co. of America	Fe V
Total - all companies	
Delco-Remy Div. of Gen. Motors	Fe V
Detroit Alloy Steel Co.	Fe V
Detroit Elec. Furnace Co.	Fe V
Detroit Gray Iron Fdry. Co.	Fe V
Detroit Steel Casting Co.	Fe V
Libert, Bancroft & Ross Co.	Fe V
Dixton & Sons, Inc., Henry	Fe V
Dodge Steel Co.	Fe V
Drakenfeld & Co., B. F.	Ann Van
DuPont de Nemours & Co., E. I.	Van Pent
	Ann Van
Eastman Kodak Co.	Ann Van
Electric Steel Castings Co.	Fe V
Electrocast Steel Fdry. Co.	Fe V
Empire Steel Castings Co.	Fe V
Erie Forge Co.	Fe V
Etna Machine Co.	Fe V
Falk Corp.	Fe V
Farrell Cheek Steel Fdry. Co.	Fe V
Fashion Screen Print. Co.	Ann Van
Feurot Prot. & Ident. System	Sod Van
Finco Dye & Print Works	Ann Van
Fisher Scientific Co.	Van P
Foots Mineral Co.	Fe V
	Van P
	Ann Van
	Van Metal
Forging & Castg. Corp.	Fe V
Forstoria Glass Co.	Van P
Foto Shop, The	Ann Van
Frank Foundries Co.	Fe V
Funk, F.	Van P
General Chemical Co.	Fe V
	Van P
General Dyestuff Corp.	Ann Van
General Electric Co.	Fe V
General Plate Co.	Fe V
General Steel Casting Corp.	Fe V
Glendon Print Works	Ann Van
Gorham Tool Co.	Fe V
Grand Rapids Varn. Corp.	Van P
Granle & Dyer	Ann Van
Grant Bros. Fdry.	Fe V
Great Lakes Steel Corp.	Fe V
Great Pacific Fur Dye. Corp.	Ann Van
Gulf States Steel Co.	Fe V

- 3 -

CUSTOMER	MATERIAL
Gunite Foundries Corp.	Fe V
Hampton Co.	Ann Van
Harrisburg Steel Corp.	Fe V
Harriacn Steel Cstgs. Co.	Fe V
Harshaw Chemical Co.	Van P
	Ann Van
Hartford Elect. Steel Corp.	Fe V
Heppenstall Co.	Fe V
Hoffstedt, E. V.	Van Metal
Hommel Co., O.	Van P
	Ann Van
Hudson Fur Dying, Inc.	Ann Van
Industrial Steel Cstg. Co.	Fe V
Ingersoll Steel & Dies Div. -	Fe V
Borg Warner Corp.	
Interborough Chem. Co.	Ann Van
International Harvester Co.	Fe V
Jessop Steel Co.	Fe V
	Van P
Johns Hopkins Univ.	Van P
	Ann Van
	So Van
Johnson Co., Adolph	Fe V
Jones & Laughlin Steel Corp.	Fe V
Kahl Iron Fdry., Fred.	Fe V
Kansas City Lab. Sup. Co.	So Van
Kellogg & Co., M.W.	Van P
	Ann Van
Keokuk Steel Cstgs. Co.	Fe V
Kerr Co., Frank W.	So Van
	Van Metal
Kilby Car & Fdry. Co.	Fe V
Kinite Corp.	Fe V
Laboratory Materials Co.	Ann Van
Letrobe Elec. Steel Co.	Fe V
Lebanon Steel Fdry. Co.	Fe V
Lenigh Foundries, Inc.	Fe V
Lennig & Co., Inc. Chas.	Ann Van
Liv Locomotive Works	Fe V
Locomotive Fin. Mat'l Co.	Fe V
Loenstein & Sons, J. H.	Ann Van
Ludlum Steel Co.	Fe V
Luzens Steel Co.	Fe V
Machined Steel Cstg. Co.	Fe V
Malleable Iron Fittings Co.	Fe V
Malloy & Co., P. R.	Van P
Manufacture Print works	Ann Van
Marion Steam Shovel Co.	Fe V
Mason Color & Chem. Co.	Ann Van
Mass. Inst. of Tech.	So Van
Massillon Steel Cstgs. Co.	Fe V
Maynard Elec. Steel Cstg. Co.	Fe V
McKay, A. D.	Van Metal
Mifford Chemical Co.	Ann Van

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CUSTOMER	MATERIAL
Michigan Bumper Corp.	Van P
Michigan Steel Ctg. Co.	Fe V
	Van Metal
Michiana Products Corp.	Fe V
Midvale Co.	Fe V
Millard Heath Co.	Van P
Monroe Steel Ctg. Co.	Fe V
Motor & Mach. Ctg. Co.	Fe V
Nat'l Aniline & Chem. Co.	Van P
Nat'l Forge & Ordnance Co.	Fe V
Nat'l Supply Co. of Calif.	Fe V
N. J. Lab. Sup. Co.	Van P
	Ann Van
Norfolk & Western Ry. Co.	Fe V
Ohio Steel Fdry. Co.	Fe V
Oliqort, Joseph	Ann Van
Omaha Steel Works	Fe V
Osgood Co., The Charles	Ann Van
Parker Pen Co.	Ann Van
Parish & Thompson, Inc.	So Van
Pettibone Milliken Co.	Fe V
Polytechnic Inst. of Balyn.	Fe V
Proximity Mfg. Co.	Ann Van
Reliable Ink & Stat. Co.	Ann Van
Reliance Steel Ctg. Co.	Fe V
Republic Steel Corp.	Fe V
Rogers Laboratories	Van P
Ross Machine Fdries.	Fe V
Saint Francis College	Van Metal
Sargent Co., E. H.	Van P
	Ann Van
Sawbrook Steel Castings	Fe V
Schaar & Co.	Van P
Schering & Co.	Van P
Shell Development Co.	Van P
Sherwin-Williams Co.	Van P
	Ann Van
Sinonds Saw & Steel Co.	Fe V
Siryer Steel Ctg. Co.	Fe V
Sirtex Printing Co.	Ann Van
Smith Corp., A.O.	Van P
Sorbo-Mat Process Eng.	Fe V
Special Chemicals Corp.	Van P
Standard Brake Shoe & Fdry. Co.	Fe V
Std. Elec. Steel Casting Co.	Fe V
Standard Steel & Wire Co.	Fe V
	Van P
Standard Steel Works Co.	Fe V
Sterling China Co.	Ann Van
Sterling Steel Ctg. Co.	Fe V
Sterling Steel Fdry. Co.	Fe V
Stifel & Son, J. L.	Ann Van
Stoody & Co.	Fe V

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CUSTOMER	MATERIAL
Superior Fdry. Co.	Fe V
Texas Chemical	Ann Van
Textor Chemical Lab.	Van P
Thomas Co., Arthur H.	Ann Van
Tiaken Roller Bearing Co.	Fe V
Toledo Camera Shop	Ann Van
Unacas Finishing Co.	Ann Van
Union Oil Co. of Calif.	Ann Van
Union Spring & Mfg. Co.	Fe V
United Eng. & Fdry. Co.	Fe V
United States Steel Corp. - Total	Fe V
Universal Cyclops Steel Corp.	Fe V
University of Pennsylvania	So Van
University of Pittsburgh	Van P
Valley Mould & Iron Corp.	Ann Van
Vanadium Alloys Steel Co.	Fe V
Van Vo-st, Albert B.	Fe V
	Ann Van
	So Van
Verona Chemical Co.	Van P
Victor Chemical Co.	Van P
Vulcan Crucible Steel Co.	Fe V
Walker & Co., Geo. T.	V Metal
Wallwork Fdry. Co.	Fe V
Wallworth Co.	Fe V
Washburn Wire Co.	Fe V
Warwick Chin & Co.	Ann Van
West Michigan Steel Fdry. Co.	Fe V
West Steel Castg. Co.	Fe V
Western Elec. Co.	Van P
Westinghouse Elec. & Mfg. Co.	Fe V
Wilson Welder & Metals Co.	Fe V
Worth Steel Co.	Fe V
Zimmerman Steel Co.	Fe V

CANADIAN

Canada.. Brake Shoe & Fdry. Co.	Fe V
Donalson Foundries & Steel, Ltd.	Fe V

1936 DOMESTIC AND CANADIAN PRICE RANGES

Fe VOH	\$2.70 per lb Ctd V	Ann Van	\$1.90 to \$2.20 per pound
Fe V Cru	2.80 per lb Ctd V	V Met. 90%	4.10 to 4.30 " "
Fe V Pri	2.90 per lb Ctd V	V Met. 95%	.40 to .45 per gram
V Pent	1.10 per lb Ctd V205 to	V Pent CP	15.00 per pound
	1.25 per pound Mat'l	Ann Van CP	7.00 per pound
		Sod O Van	1.65 to 3.25 per pound

Prices the same to all customers for similar quantities, sizes - on contract and spot bases. Special Grinding and quality extras not indicated in above standard prices.

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VANADIUM CORPORATION OF AMERICA

Sales of Vanadium Ore, Flue Dust, Vanadic Acid (Vanadium Pentoxide), Ferro Vanadium and Price Ranges

YEAR - 1937

DOMESTIC

CUSTOMER	MATERIAL
A. C. Sparks Plug Division - G. M. C.	Van Pent
Acme Foundry Co.	Fe Van
Adirondack Foundries & Steel, Inc.	Fe Van
Ahern Textile Print	Ann M Van
Alan Wood Steel Co.	Fe Van
Allegheny Steel Co.	Fe Van
Alloy Cast Steel Co.	Fe Van
Alloy Steel & Metals Co.	Fe Van
Althouse Chemical Co.	Van Pent
American Art Textile Printing Co.	Ann M Van
American Cyanamid and Chemical Co.	Ann M Van
	Van Pent
American Locomotive Works	Fe Van
American Steel Foundries Co.	Fe Van
Apex Foundry Co.	Fe Van
Arnold Print Works	Ann M Van
Atlantic Foundry Co.	Fe Van
Atlas Steel Casting Co.	Fe Van
Auto Specialties Mfg. Co.	Fe Van
Babcock and Wilcox Co.	Fe Van
Barrett Co.	Van Pent
Beck, Koller and Co., Inc.	Van Pent
Bell Telephone Laboratories	Fe Van
Beltramo, Inc., F. J.	Ann M Van
Bethlehem Steel Co.	Fe Van
	Van Pent
Bettendorf Co.	Fe Van
Birdsboro Steel Foundry & Mach. Co.	Fe Van
Blue Valley Foundry Co.	Fe Van
Boericke & Runyon	90% Van Metal
Bonney Floyd Co.	Fe Van
Bornen & Kensington Co.	Ann M Van
Boyer, W. T.	Fe Van
	90% Van Metal
Brasburn Alloy Steel Corp.	Fe Van
Braun Corp.	Ann M Van
Braun-Knecht-Heimann Co.	Van Pent C P
Brewer & Co.	Ann M Van
Burnside Steel Foundry Co.	Fe Van
Calco Chemical Co.	Sod O Van
Calumet Steel Casting Co.	Fe Van
Capital Paint & Varnish Co.	Van Pent
Carbic Color & Chemical Co.	Ann M Van
	Van Pent
Carus Chemical Co.	Fe Van
Central Iron Foundry Co.	

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CUSTOMER

MATERIAL

Central Scientific Co.

Van Pent

Chain Belt Co.

Sod O Van

Chicago Malleable Castings Co.

Fe Van Cru

Ciba Co.

Fe Van

City Chemical Co.

Ann M Van

Clark Equipment Co.

Sod O Van

Cleveland Graphite Bronze Co.

Fe Van

Climax Molybdenum Corp.

95% Van Metal

Comet Metals & Reduction Co.

Fe Van Pri

Cold Springs Bleachery

90% Van Metal

Colonial Steel Co.

Ann M Van

Calorey Corp.

Fe Van

Columbia University

Ann M Van

Fe Van

Van Pent

Van Pent C P

Continental Roll & Steel Fdry. Co.

Fe Van

Corhart Refractories Co.

Van Pent

Cranston Print Works

Ann M Van

Crosbitt, Inc.

Mn V Alloy

Crucible Steel Casting Co.

Fe Van

Crucible Steel Co. of America

Fe Van

Daigger & Co., A.

Van Pent

Deener Steel Casting Co.

Fe Van

Dennis Co., Martin

Van Pent

Detroit Alloy Steel Co.

Fe Van

Detroit Steel Casting Co.

Fe Van

Dibert, Bancroft & Ross Co.

Fe Van

Diston & Sons, Inc., Henry

Fe Van

Drakenfeld & Co., D. F.

Van Pent

duPont deMeneours & Co., E. I.

Ann M Van

Van Pent

Eastman Kodak Co.

Ann M Van

Eaton Detroit-Metal Co.

Ann M Van C. P.

Ann M Van

Van Pent

Ann M Van

Sod O Van

90% Van Metal

95% Van Metal

Ehrhart & Karl Co.

Fe Van

Electric Steel Casting Co.

Fe Van

Electrocast Steel Foundry Co.

Fe Van

Empire Steel Casting Co.

Fe Van

Erie Forge Co.

Fe Van

Etna Machine Co.

Fe Van

Felt Corp.

Sod O Van

Faurot Protective & Identification Sys.

Fe Van

Ferrolegeringer

Van Pent

Foote Mineral Co.

Ann M Van

Forging & Casting Corp.

Fe Van

Francis & Hygren Foundry Co.

Fe Van

Frank Foundries Corp.

Fe Van

Gangwer & Co., I. D.

Fe Van

General Chemical Co.

Van Pent

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CUSTOMER

General Byestaff Corp.
 General Electric Co.
 General Motors Co.
 General Steel Casting Corp.
 Gosling Chemical Co.
 Glenlyn Print Works
 Goodrich Co., D. F.
 Gorham Tool Co.
 Grant Bros. Foundry Co.
 Great Lakes Steel Corp.
 Greiner Co., Otto R.
 Hamilton Foundry & Mach. Co.
 Hampton Co.
 Harrisburg Steel Corp.
 Harrison Steel Casting Co.
 Hershaw Chemical Co.
 Hart Bros. Machine Co.
 Hartford Electric Steel Corp.
 Harvard University

 Heinicke, Dr. Wn.
 Heppenstall Co.
 Hercules Powder Co.

 Heyden Chemical Corp.
 High Speed Steel Alloys, Ltd.
 Hoofstadt, E. V.
 Hommel Co., O.
 Holland Aniline Dye Co.
 Hudson Fur Dyeing, Inc.
 Huisking, Co., Chas. L.
 Humble Oil & Refining Co.
 Hunsperger, Dr. F.
 Hyuro Eng. & Chemical Co.

 Ingersoll Steel & Disc Div.
 Jessop Steel Co.
 Johns Hopkins University
 Johnson & Co., Chas. E.
 Jones & Laughlin Steel Corp.
 Kahl Iron Co., Frederick
 K. C. Laboratory Supply Co.
 Kerr Co., Frank W.
 Lecker, J. A.
 Lake Erie Foundry Co.
 Larrison, T.
 Latrobe Electric Steel Co.
 Lebanon Steel Foundry Co.
 Lenigh Foundries, Inc.
 Leunig & Co., Chas.
 Levy Co., Inc., Fred M.
 Lewis Chemical Co.
 Locomotive Finished Materials Co.
 Los Angeles Chemical Co.
 Lovenstein & Sons, J. M.

MATERIAL

Ann M Van
 Fe Van
 Fe Van
 Fe Van
 Van Pent
 Ann M Van
 Van Pent
 Fe Van
 Fe Van
 Fe Van
 Fe Van
 Ann M Van
 Fe Van
 Ann M Van
 Fe Van
 Fe Van
 Van Pent
 Fe Van
 Fe Van
 Fe Van
 Van Pent C P
 Sod O Van
 Fe Van
 Van Pent
 Ann M Van
 Ann M Van
 Fe V
 90% Van Metal
 Van Pent
 Sod O Van
 Ann M Van
 Van Pent
 Van Pent
 Sod O Van
 Ann M Van
 Sod O Van
 Fe Van
 Fe Van
 Ann M Van
 Van Pent
 Fe Van
 Fe Van
 Sod O Van Comm.
 Ann M Van
 90% Van Metal
 Fe Van
 Fe Van
 Fe Van
 Fe Van
 Fe Van
 Ann M Van
 Ann M Van
 Ann M Van
 Fe Van
 Van Pent
 Ann M Van

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CUSTOMER	MATERIAL
Ludlum Steel Co.	Fe Van
Lukens Steel Co.	Van Pont
Lukensheimer Co.	Fe Van
Machined Steel Casting Co.	Fe Van
Mackay A. D.	Fe Van
Madison H. R.	90% Van Metal
Mallery & Co.	Ann M Van
	Fe Van
	Van Pont
Mann & Co., Inc., Geo.	Ann M Van
Marion Stann Shovel Co.	Fe Van
Massillon Steel Casting Co.	Fe Van
Maynard Elec. Steel Casting Co.	Fe Van
McArthur Chemical Co.	Ann M Van
Metal & Thermit Corp.	Fe Van
Michiana Products Corp.	Fe Van
Michiana Steel Casting Co.	Fe Van
Midvale Co.	Fe Van
Miller, C. Franklin	Van Pont
	Ann M Van
Milwaukee Steel Foundry Co.	Fe Van
Monroe Steel Castings Co.	Fe Van
Motor & Machinery Castings Co.	Fe Van
National Aniline & Chemical Co.	Van Pont
National Dyeing & Printing Co.	Ann M Van
National Forge & Ordnance Co.	Fe Van
National Malleable & Steel Cstg. Co.	Fe Van
National Supply Co. of Delaware	Fe Van
Nelson T. Holland	90% Van Metal
Norfolk & Western Railway Co.	Fe Van
North Bros. Mfg. Co.	Fe Van
Northern Pump Co.	Fe Van
North West Barb Wire Co.	Fe Van
Nutmeg Crucible Steel Co.	Fe Van
Ohio Steel Foundry Co.	Fe Van
Omaha Steel Works	Fe Van
Osgood Co., Chas.	Ann M Van
Parker Fan Co.	Ann M Van
Pennsylvania Elec. Steel Cstg. Co.	Fe Van
Perennial Dye & Prt. Wks.	Ann M Van
Permutit Co.	Ann M Van
	Van Pont
Pittsburgh Steel Foundry Corp.	Fe Van
Polytech Inst. of Brooklyn	Fe Van
Pood Lily Co.	Ann M Van
Pylon Products Co.	Ann M Van
Rapid Copy Service Co.	Ann M Van
Reliable Ink & Stationery Co.	Ann M Van
Reliance Steel Castings Co.	Fe Van
Republic Steel Corp.	Fe Van
Riley Stoker Corp.	Fe Van Cru
	Fe Van Pri
Robertshaw Thermostat Co.	90% Van Metal

CUSTOMER

MATERIAL

Wagner Drug Co.
 Ross Meehan Foundry
 Rumford Chemical Works

Saginaw Malleable Iron
 Sargent Co., E. H.

Sawbrook Steel Castings
 Schenectady Hyg. Lab.
 Scientific Glass App. Co.
 Sisona Saw & Steel Co.
 Sirtex Printing Co.
 Sivyer Steel Casting Co.
 Smith Corp., A. O.
 Smith Steel Foundry Co.
 Smith, Walden A.
 Sorbo-Mat Process Eng.
 Sperlan Products Co.
 Standard Broke Shoe & Fdry. Co.
 Standard Elec. Steel Casting Co.
 Standard Oil Development Co.
 Standard Steel Works Co.
 Sterling Steel Casting Co.
 Sterling Steel Foundry Co.
 Superior Steel & Mill. Cstgs. Co.
 Szabo & Beer
 Tanning Process Co.
 Terre Haute Mill. & Mfg. Co.
 Texas Chemical Co.
 Textile Chemical Co.
 Thomas Co., Arthur H.
 Tinken Rolling Bearing Co.
 Toye & Co., Jos.
 Treadwell Eng. Co.
 Trenton Potteries Co.
 Turner & Co., Jos.

Union Steel Casting Co.
 Unitcast Corp.
 U. S. Metal Refining Co.
 U. S. Steel Corp.
 Universal-Cyclops Steel Corp.
 University of Illinois
 University of Minnesota
 Valley Drug & Chemical Co.
 Valley Paint & Chemical Co.
 Vanadium Alloys Steel Co.
 Var-Loc-Old Chemical Co.

Victor Chemical Works
 Vitro Manufacturing Co.
 Vulcan Crucible Steel Co.
 Vulcan Iron Works
 Waldrich Co.
 Walker & Co., Geo. T.

Van Pent C. P.
 Fe Van
 Van Pent
 Sod O Van
 Fe Van
 Ann M Van
 Sod O Van
 Fe Van
 Ann M Van
 Ann M Van
 Van Pent
 Ann M Van
 Fe Van
 Van Pent
 Fe Van
 97% Van Metal
 Fe Van
 Fe Van
 Fe Van
 Fe Van
 Ann M Van
 Fe Van
 Fe Van
 Fe Van
 Fe Van
 Fe Van
 90% Van Metal
 Ann M Van
 Fe Van
 Ann M Van
 Ann M Van
 Sod O Van
 Fe Van
 Fe Van
 Fe Van
 Van Pent
 Van Pent
 90% Van Metal
 Fe Van
 Fe Van
 90% Van Metal
 Fe Van
 Fe Van
 Van Pent Tech
 Sod O Van
 Ann M Van
 Ann M Van
 Fe Van
 Van Pent, Tech.
 Van Pent, Purified
 Van Pent
 Van Pent
 Fe V Cru
 Fe Van
 Ann M Van
 Van Pent
 Ann M Van

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CUSTOMER

MATERIAL

Washburn Wire Co.
 Wehr Steel Co.
 West Michigan Steel Casting Co.
 West Steel Casting
 Westinghouse Elec. & Mfg. Co.
 Whipple & Cheate Co.
 Wirt Co.
 Youngstown Foundry & Mach. Co.
 Youngstown Sheet & Tube Co.

Fe Van
 Fe Van
 Fe Van
 Fe Van
 Fe Van
 Fe Van
 Van Pont
 Fe Van
 Fe Van

CANADIAN

Canadian Brake Shoe
 Canadian Car & Foundry
 Dominion Foundry

Fe Van
 Fe Van
 Fe Van

1927 DOMESTIC AND CANADIAN PRICE RANGES

Fe Van O H	- \$2.70 per lb. Ctd. V
Fe Van Cru	- 2.80 per lb. Ctd. V
Fe Van Pri	- 2.90 per lb. Ctd. V
Van Pont	- 1.10 per lb. Ctd. V ₂ O ₅ to \$1.25 per lb. material
Ans M Van	- 1.90 to 2.20 per pound
Van Metal 90%	- 4.10 to 4.50 per pound
Van Metal 95%	- .40 to .45 per gram
Van Pont C.P.	- 15.00 per pound
Ans M Van C.P.	- 7.00 per pound
Sod O Van	- 1.65 to 3.25 per pound

Prices the same to all customers for similar quantities, sizes - on contract and spot basis. Special grinding and quality extras not indicated in above standard prices.

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VANADIUM CORPORATION OF AMERICA

Sales of Vanadium Ore, Flue Dust, Vanadic Acid
(Vanadium Pentoxide) and Ferro Vanadium

and Price Ranges

Domestic

Year - 1938

FeV - lbs. Ctd. V
V Pent - lbs. Ctd. V205
Others - PoundsCUSTOMERMATERIAL

A.C. Spark Plug Div. Gen. Motors
Abrasive Dressing Tool Co.
Aase Foundry Co.
Adirondack Foundries Steel, Inc.
Alan Wood Steel Co.
Allegheny Ladium Steel Corp.
American Art Textile Printing Co.
American Brake Shoe & Fdry. Co.
American Car & Fdry. Co.
American Chain & Cable Co.
American Cyanamid & Chemical Co.

V Pent CP
V Metal
FeV
FeV
FeV
FeV
FeV
ArmVVan
FeV
FeV
V Pent
V Pent
ArmVVan
FeV
V Pent
FeV
FeV
ArmVVan
FeV

American Locomotive Co.
American Smelting & Refining Co.
American Steel Foundries
Ann Arbor Fdry. Co.
Arnold Print Works
Atlantic Fdry. Co.

FeV
FeV
ArmVVan
"
FeV
FeV
FeV
V Pent
V Pent
ArmVVan
FeV
V Pent
FeV
FeV
ArmVVan
V Pent
FeV
ArmVVan
ArmVVan
FeV
FeV
V Pent
FeV

Babcock & Wilcox Co.
Bell Telephone Laboratories
Bus Chemical Co.
Burner & Co. A.V.
Bethlehem Steel Co.
Bonney Floyd Co.
Braeburn Alloy Steel Co.
Braun Corp.
Braun-Knaht-Hermann Co.
Brewer & Co.
Burnside Steel Fdry. Co.
Calco Chemical Co.
Calumet Steel Castings Corp.
Campbell Syant & Cannon Fdry. Co.
Carbic Color & Chemical Co.
Carus Chemical Co.
Central Iron Fdry. Co.
Central Scientific Co.
Ceramic Color Chem. Mfg. Co.
Chapman Valve Mfg. Co.
Chicago Malleable Castg. Co.
Cith Chemical Co.
Clark Equipment Co.

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Domestic-2-
Year - 1938CUSTOMERMATERIAL

Glinax Molybdenum
Cole Co. N
Cold Spring Bleaching
Colonial Steel Div.
Columbia University
Consolidated Chemical Industrial

FeV
V Pent CP
Arm/Van
FeV
V Pent CP
Arm/Van
Arm/Van CP
Arm/Van
FeV
Arm/Van
FeV
FeV
FeV
FeV

Consolidated Dyestuff Corp.
Continental Roll, Steel Fdry.
Cranston Print Works
Crobalt Inc.
Crucible Steel Castg. Co.(Pa.)
Crucible Steel Castg. Co.(Milw.)
Crucible Steel Co. of America

V Pent CP

Daigger & Co. A.

VPent

Damascus Steel Castg. Co.
Damer Steel Castg. Co.
Dennis Co., Martin

FeV
FeV
V Pent
Arm/Van
V Metal
FeV
FeV
FeV

Denver Fire Clay Co.
Detroit Alloy Steel Co.
Detroit Steel Castg. Co.
Diston & Sons Inc., Henry
Drahenfeld & Co. B. F.

V Pent
Arm/Van
SodVan
V Pent
V Pent CP
Arm/Van CP

E. I. DuPont de Nemours Co.

V Pent
V Pent

E. A. Laboratories
Eberbach & Son Co.
Electric Steel Castg. Co.
Elmira Foundry Co.
Erie Forge Co.
Etna Machine Co.

FeV
FeV
FeV
FeV
FeV

Falk Corporation
Ferro Mach. & Fdry. Co.
Forping & Castg. Corp.
Fort Pitt Steel Castg. Co.
Frances & Myron Fdry. Co.

FeV
FeV
FeV
FeV
FeV

General Chemical Co.

Arm/Van CP

General Dyestuff Corp.
General Electric Co.
General Motors Research
General Steel Castg. Co.
Gessing Chemical Co.
Glenlyan Print Works

Arm/Van
Arm/Van
Arm/Van
FeV
FeV
FeV
V Pent
Arm/Van

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Domestic

Year - 1938

CUSTOMERMATERIAL

Glover Steel Co.
Gorham Tool Co.
Grand Rapids Fdry.
Grant Bros. Fdry. Co.
Great Lakes Steel Corp.

FeV
FeV
FeV
FeV
FeV

Hackett Brass Fdry.
Hampton Color & Chem. Co.
Hampton Co.
Hanchett Mfg. Co.
Hansell Klock Co.
Harty Inc. Chas.
Harshaw Chemical Co.
Hartford Elec. Steel Corp.
Hoopenstall Co.
Hercules Powder Co.
Hobart Mfg. Co.
Hoopstadt E. V.
Hornel Co. O.
Hughes Tool Co.
Hydro Eng. & Chem. Co.
Industrial Castings Co.
Ingersoll Steel & Disc
International Harvester Co.
International Nickel Co.

V Pent
ArmVan
ArmVan
FeV
FeV
V Metal
V Metal
FeV
FeV
ArmVan
FeV
V Metal
V Metal
V Pent
FeV
V Pent CP
FeV
FeV
FeV
V Metal

Jessop Steel Co.
Jones & Laughlin Steel Corp.

FeV
FeV

Kincaid-Osburn Elec. Steel Co.
Kahl Iron Co.
Kansas City Lab. Supply
Knoxington Steel Co.
Koopuk Steel Ctg. Co.
Killy Car & Fdry. Co.
Letrobe Elec. Steel Co.
Lebanon Steel Fdry. Co.
Lehigh Foundries
Lennig & Co., Chas.
Levy & Co. Fred'k.

FeV
FeV
Cod Van
FeV
FeV
FeV
FeV
FeV
FeV
ArmVan
V Pent
ArmVan
V Pent
FeV
ArmVan
FeV

Lindsay Light & Chem. Co.
Locomotive Fin. Mat'l Co.
Lowenstein & Sons, T.H.
Lukens Steel Co.

FeV
V Metal
FeV
VPent
FeV

Machined Steel Ctg. Co.
A. D. Mackay
Mackintosh-Humphill
Mallory & Co., P. R.
Marion Steam Shovel Co.

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Domestic

Year - 1938

CUSTOMERMATERIAL

Mass. Inst. of Tech.
 Maynard Elec. Steel Castg. Co.
 McArthur Chemical Co.
 Michiana Products Corp.
 Michigan Steel Castings
 Midvale Co.
 Miller C. Frank
 Milwaukee Steel Fdry. Co.
 Molybdenum Corp. of America
 Monroe Steel Castings Co.
 Munning & Munning, Inc.
 Muskegon Piston Ring Co.

V Pent CP
 FeV
 Amn/Van
 FeV
 FeV
 FeV
 V. Pent
 FeV
 V Pent
 FeV
 Amn/Van
 FeV

National Aniline & Chem. Co.
 National Dyeing & Printing Co.
 National Forge & Ordnance Co.
 National Mall & Steel Castings
 National Supply Co. of Del.
 New Jersey Zinc Co.
 Nobilium Products
 Ohio Steel Fdry. Co.

V Pent
 Amn/Van
 FeV
 FeV
 FeV
 V Metal
 V Metal
 FeV

Pacific Mills
 Pamplus Co.
 Parke Davis & Co.
 Parker Pen Co.
 Pa. Elec. Steel Castg. Co.
 Perkins Machine & Gear Co.
 Permutit Co.
 Phillips & Co. C. E.
 Phillips Dental Lab.
 Pittsburgh Fdry. & Machine
 Pittsburgh Plate Glass Co.
 Pollack, Alex W
 Pond Lily Co.
 Porcelain Enamel & Mfg.
 Prescott & Co.
 Purdue University

Amn/Van
 Sod/Van
 V Pent
 Amn/Van
 FeV
 V Metal
 Amn/Van
 VPent
 FeV
 FeV
 V Pent
 V Metal
 Amn/Van
 V Pent
 Amn/Van
 V Pent

Redwig Potteries, Inc.
 Reilly Tar & Chemical Co.
 Reliance Steel Castings Co.
 Republic Steel Corp.
 Research Products Co.

V Pent
 V Pent
 FeV
 FeV
 V Pent
 V Pent CP
 FeV
 V Pent
 Amn/Van
 Amn/Van
 FeV
 FeV

Riley Stoker Corp.
 Robinson-Ransbottom Battery
 Roemer Drug Co.
 Ross Nechan Foundries
 Rotary Electric Steel Co.

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Domestic

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Year - 1938CUSTOMERMATERIAL

Rouse & Shearer Inc.
Rustless Iron & Steel Corp.

V Pent
FeV

Saginaw Mall. Iron Div. O.M.C.
Sandell H. E.
Sargent Co. E. H.
Sawbrook Steel Castings Co.
Seldner & Anquist, Inc.
Simonds Saw & Steel Co.
Sixtex Printing Co.
Smith Corp. A. O.
Smith Steel Foundry Co.
Solvay Process Co.
Standard Elec. Steel Ctg.
Standard Oil Development
Standard Steel Works Co.
Stauffer Chemical Co.
Sterling Steel Castings Co.
Sterling Steel Fdry. Co.
Stefel & Sons J. L.
L. E. Stone
Stoody Co.
Sulmet Alloys Co.
Swedish Crucible Co.
Taylor Wharton Iron & Steel
Textile Chemical Co.
Timken Roller Bearing Co.
Titanium Alloy Mfg. Co.
Tolick Jr.
Toys Co. Joseph
Treadvill Eng. Co.
Turco Products Inc.
Turner Co. - Joseph

FeV
V Pent
V Pent
FeV
V Pent
FeV
ArmVVan
V Pent
FeV
ArmVVan
FeV
ArmVVan
FeV
V Pent
FeV
FeV
ArmVVan
V Metal
V Metal
V Pent
FeV
FeV
ArmVVan
FeV
FeV
V Metal
FeV
FeV
V Pent
V Metal
V Pent

Union Spring & Mfg. Co.
Union Steel Castings Co.
Unitcast Corp.
U. S. Steel Corp.
Universal-Cyclops Steel Co.
University of Florida
University of Illinois

FeV
FeV
FeV
FeV
FeV
ArmVVan
V Pent
FeV

Volles Paint & Chemical
Valley Steel Casting Co.
Vanadium Alloys Steel Co.
Var-Lar Ord. Chemical Co.
Velsical Corp.
Victor Chemical Co.
Vitro Mfg. Co.

ArmVVan
FeV
FeV
V Pent
ArmVVan
V Pent
V Pent

[fol. 97]

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Domestic**Year - 1938****CUSTOMER****MATERIAL**

Vulcan Alloy Corp.
 Vulcan Crucible Steel Co.
 Vulcan Iron Works
 Waldrich Co.
 Walker & Co., Geo. T.
 Walters Brass Fdry.
 Washburn Wire Co.
 Wehr Steel Co.
 Welsh Mfg. Co.
 West Michigan Steel Fdry.
 West Steel Casting
 Westinghouse Elec. & Mfg. Co.
 Wheeling Tile Co.
 Whipple & Choate Co.
 Wilson Walder Metals
 Worthington Pump Mach. Co.
 Yale & Towne Mfg. Co.
 Youngstown Fdry. & Machine
 Youngstown Sheet & Tube Co.

V Metal
 FeV
 FeV
 AnnHVan
 SodVan
 V Pent
 FeV
 FeV
 SodVan
 FeV
 FeV
 FeV
 AnnHVan
 FeV
 FeV
 FeV
 FeV
 FeV
 FeV

CANADIAN

Canadian Brake Shoe & Fdry. Co.
 Dominion Foundries & Steel Ltd.

FeV
 FeV

1938 Domestic and Canadian Price Ranges

FeV CM - \$2.70 to \$2.80 per lb. std. V
 FeV Cru - \$2.80 to \$2.90 per lb. std. V
 FeV Pri - \$2.90 to \$3.00 " " "
 V Pent - \$1.10 per lb. std. V205 to \$1.25 per lb. mt'l
 AnnHVan - \$1.90 to \$2.10 per lb. (effective 9/1/38 -
 \$1.90 to \$2.30 per lb.)
 V Metal 90% - \$4.10 to \$4.50 per lb. std. V (effective
 9/15/38 - \$3.30 to \$3.50 per lb. std. V.)
 V Metal 95% - \$0.40 to \$0.45 per gram
 SodVan - \$1.65 to \$2.25 per lb. (effective 10/15/38 -
 \$0.90 to \$2.20 per lb.)
 V Pent CP - \$7.00 per lb.
 AnnHVan CP - \$7.00 per lb.

Prices the same to all customers for similar quantities, sizes, on contract and spot bases. Special grinding and quality extras are not indicated in above standard prices.

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VANADIUM CORPORATION OF AMERICA

Sales of Vanadium Ore, Flue Dust, Vanadic Acid
(Vanadium Pentoxide) & Ferrous Vanadium

and Price Ranges

Domestic

Year - 1939

CUSTOMERMATERIAL

Acme Foundry Co.	Fe V
Adirondack Foundries & Steel	"
Advance Foundries Co.	"
Abern Textile Print	AmidVan
Alan Wood Steel Co.	Fe V
Allegheny Ludlum Steel Corp.	"
" " "	V Pent
Alley Steel & Metal Company Inc.	Fe V
American Art Textile Prtg. Co.	AmidVan
American Brake Shoe & Fdry Co.	Fe V
American Car & Foundry Co.	"
American Cast Iron Pipe Co.	"
American Cyanamid & Chem. Co.	V Pent
American Fdry. Equipment Co.	Fe V
American Locomotive Co.	"
American Steel Castings	"
American Steel Foundries	"
Apex Foundry Company	"
Arrieri Co. Eugenio	V Pent
" " "	V Metal
Aracoda Corp.	Fe V
Arnold Print Works	AmidVan
Auto Specialty Mfg. Co.	Fe V
Babcock & Wilcox Co.	"
Barrett Co.	V Pent
Bell Telephone Lab.	Fe V
Belle City Malleable Iron Co.	"
Belmont Smelting & Refining Co.	V Metal
Berg Chemical Company	AmidVan
Bethlehem Steel Company	FeV
Bond Mfg. Corp. Inc.	Sod O Van
Bonney - Floyd Co.	Fe V
Brasburn Alloy Steel Co.	"
Brassart & Co., H. A.	V Metal
Brewer & Co. Inc.	AmidVan
Burnside Steel Foundry Co.	Fe V
Burrell Technical Supply Co.	V Pent
Calco Chemical Co. Inc.	"
Calumet Steel Castings Corp.	Fe V
Carbis Color & Chemical Co.	AmidVan
Carborundum Co.	V Pent
Carus Chemical Co.	"
Central Iron Foundry Co.	Fe V
Century Electric Company	"
Chapman Valve Mfg. Co.	"
City Chemical Co.	"
" " "	V Pent

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Domestic

CUSTOMER

City Chemical Co.
 " "
 Clark Equipment Co.
 Cold Spring Bleachery
 Cole Co., N.
 Colonial Steel Div.
 Columbia University
 Continental Roll & Steel "dry
 Corning Glass Works
 Crane Co.
 Crobalt Inc.
 Crucible Steel Casting Co.
 Crucible Steel Co. of America
 Detroit Alloy Steel Co.
 Detroit Steel Casting Co.
 Diston & Sons, Inc. Henry
 Doe & Ingalls Inc.
 Drakenfield & Co. Inc. B. F.
 " "
 DuPont de Nemours & Co. Inc.
 Duraloy Company
 E. A. Laboratories Inc.
 Eastman Kodak Co.
 " "
 Edgewater Steel Co.
 Eimer & Amend
 Electric Steel Casting Co.
 Enequist Chemical Co. Inc.
 Erie Forge Co.
 Etna Machine Co.
 Fairmount Chemical Co. Inc.
 Falk Corp.
 Faurot Protective & Indem.
 Ferro Enamel Corp.
 Foote Mineral Co.
 " "
 Ford Motor Co.
 " "
 Forging & Casting
 Fort Pitt Steel Casting Co.
 General Chemical Co.
 General Drystuff Corp.
 General Electric Co.
 General Steel Casting Corp.
 Glover Machine Co.
 Gorham Tool Co.
 Gould Coupler Corp.
 Great Lakes Steel Corp.
 Greiner Co., Mail
 Hampton Co.
 Hansell Kleeck Co.
 Hardy, Inc., Charles
 Harrison Steel Castings
 Harsco Chemical Co.

-2-

Year - 1939

MATERIAL

V Metal
 SodOVan
 Fe V
 ArmOVan
 V Pent
 Fe V
 V Pent CP
 Fe V
 V Pent
 Fe V
 V Metal
 Fe V
 "
 "
 "
 "
 ArmOVan CP
 V Pent
 ArmOVan
 V Pent
 Fe V
 V Pent
 "
 ArmOVan
 Fe V
 SodOVan
 Fe V
 ArmOVan
 Fe V
 "
 V Metal
 Fe V
 SodOVan
 V Pent
 Fe V
 V Pent
 "
 ArmOVan
 Fe V
 "
 V Pent
 ArmOVan
 Fe V
 "
 "
 "
 "
 "
 "
 ArmOVan
 "
 Fe V
 V Metal
 Fe V
 V Pent

[fol. 100]

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Domestic

Year - 1939

CUSTOMERMATERIAL

Hartford Electric Steel Corp.	FeV
Heppenstall Co.	FeV
Hercules Powder Co.	AnnulVan
Herstein Laboratories Inc.	V Pent
Hobart Mfg. Co.	FeV
Hommel Co., O.	V Pent
Hudson Fur Drying Inc.	AnnulVan
Hughes Tool Co.	FeV
Hydro Engineering & Chem. Co.	AnnulVan
Standard Oil Co. of Louisiana	V Pent CP
Imperial Type Metal Co.	V Metal
Ingersoll Steel & Disc. Div.	FeV
Inland Steel Co.	"
Int'l Harvester Co. Inc.	"
Jackson & Church Co.	"
Jessop Steel Co.	"
Jones & Laughlin Steel Corp.	"
Kahl Iron Co., Fred'k	"
Kensington Steel Co.	"
Keokuk Steel Castings Co.	"
Knoxville Iron Co.	"
Latrobe Electric Steel Co.	"
Lebanon Steel Foundry	"
Lectromelt Steel Casting Co.	AnnulVan
Lennig & Co. Inc. Charles	V Pent
Lewis Chemical Co.	FeV
Lewiston Fdry. & Machine Co.	V Pent
Lindsay Light & Chemical Co.	FeV
Locomotive Finished Material Co.	AnnulVan
Los Angeles Chemical Co.	"
Lowenstein & Sons Inc., J. H.	FeV
Lukens Steel Co.	"
Machine Steel Casting Co.	"
Mackintosh Hemphill	V Pent
Mallory & Co. Inc. P. R.	FeV
Marion Steam Shovel Co.	V Pent
Mason Color & Chemical Wks.	AnnulVan CP
Massachusetts Inst. of Tech.	FeV
Massillon Steel Casting Co.	"
Maynard Electric Steel Casting	AnnulVan
McArthur Chemical Co. Ltd.	V Pent
McGean Chemical Co.	FeV
Mesta Machine Co.	V. Metal
Metals Disintegrating Co.	FeV
Michigan Steel Casting Co.	"
Midvale Co.	AnnulVan
Mills, C. Franklin	FeV
Milwaukee Steel Fdry Co.	"
Monroe Steel Castings	V Pent
Morton Pottery Co.	AnnulVan
"	FeV
Motor & Machinery Castings	AnnulVan
Munning & Munning Inc.	FeV
Muskegon Piston Ring Co.	AnnulVan
National Alloy Steel	FeV
	"

100

[fol. 101]

Domestic

Year - 1939

<u>CUSTOMER</u>	<u>MATERIAL</u>
National Aniline Chemical Co.	V Pent
"	AnnHVan
National Forge & Ordnance	FeV
National Malleable Steel	"
New Jersey Laboratory Supply	V Pent
Nobilium Prod. Inc.	V Metal
Ohio Steel Foundry Co.	FeV
Oklahoma Steel Castings	FeV
Paden City Pottery Co.	AnnHVan
Parker Pen Co.	"
Penn. Elec. Steel Casting Co.	FeV
Penn State College	V Pent
Permutit Co.	AnnHVan
Pfeyer & Co. Chas.	V Pent
Phillips Dental Laboratory	FeV
Phillips Petroleum Co.	AnnHVan
Pithon, Inc. Lucius	V Metal
Pittsburg Balls Div.	FeV
Pratt & Litchworth Co.	"
Proximity Mfg. Co.	AnnHVan
Rare Metals Products	V Pent
"	AnnHVan
"	SocOVan
Reichhold Chem. Inc.	V Pent
Reliable Ink & Stationery Co.	AnnHVan
Reliance Regular Corp.	FeV
Reliance Steel Cast. Co.	"
Republic Steel Corp.	"
Robinson-Ransbottom	AnnHVan
Ross-Michan Foundries	FeV
Rotary Electric Steel Co.	"
Rouse & Shearer, Inc.	V Pent
Saginaw Malleable Iron Div.	FeV
Salisbury Laboratories	AnnHVan
"	V Pent
Sargent Co. E. H.	AnnHVan
Sawbrook Steel Casting	FeV
Scientific Glass Apparatus	AnnHVan
Scurlock, L. H.	FeV
Simonds Saw & Steel Co.	FeV
Sirtex Printing Co.	AnnHVan
Sloss-Sheffield Steel & Iron Co.	FeV
Smith Corp. A. O.	V Pent
Smith Steel Fdry. Co.	FeV
Standard Elec. Steel Cast. Co.	"
Standard Oil Co. of Calif.	AnnHVan
Standard Steel Works Co.	FeV
Standard Ultramarine Co.	V Pent
Stifel & Lens, Inc. J. L.	AnnHVan
Stuart Foundry Co.	FeV
Swamet Alloys Co. Inc.	V Pent
Superior Steel & Malleable Cast. Co.	FeV
Syngerton-Could Corp.	FeV
Terre Haute Malt. & Mfg. Corp.	"
Tinken Roller Bearing Co.	"
Titanium Alloy Mfg. Co.	V Pent
Toledo Porcelain Enamel Prod.	V Pent

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Domestic

Year - 1939

CUSTOMERMATERIAL

Treadwell Engineering Co.	FeV
Union Spring & Mfg. Co.	"
Union Steel Casting	"
Unitcast Corp.	FeV
U. S. Fingerprint Prod. Inc.	SodVan
U. S. Foundries, Inc.	FeV
U. S. Steel Corp.	"
Universal-Cyclops Steel Corp.	"
University of Florida	V Pent
University of Illinois	AmnVan
Valley Paint & Chem. Co.	V Pent
Valley Steel Cast. Co.	AmnVan
Vanadium Alloys Steel Co.	FeV
Van. Allen Co. L. E.	"
Var-Lac-Oil Chem. Co.	V Pent
Verona Chemical Co.	"
Vitro Mfg. Co.	"
Vulcan Crucible Steel Co.	FeV
Vulcan Iron Works	"
Waldrich Co.	AmnVan
Washburn Wire Co.	FeV
Watt Pottery Co.	V Pent
Wehr Steel Co.	FeV
Weldrods Corp.	"
West Mich. Steel Fdry.	"
West Steel Cast. Co.	"
Westinghouse Elec. & Mfg. Co.	"
Will Corp.	AmnVan
Williams College	"
Wilson Kelder & Metals Co.	FeV
Wollen Chem. & Supply Co.	AmnVan
Worthington Pump & Mach.	FeV
Worth Steel	"
Youngstown Fdry. & Mach. Co.	"
Youngstown Sheet & Tube Co.	"
<u>CANADIAN</u>	
Canadian Brake Shoe & Fdry. Co.	FeV
" Industries, Ltd.	V Metal
Consolidated Mining & Iron Co.	V Pent
Dominion Foundries & Steel Ltd.	FeV

1939 Domestic and Canadian Price Ranges

FeV GH \$2.70 to 2.80 per Lb. Ctd. V
 FeV Cru. \$2.80 to 2.90 per Lb. Ctd. V
 FeV Prim. \$2.90 to 3.00 " " "
 V Pent \$1.10 per Lb. Ctd. V205 to 1.25 per Lb. Material
 AmnVan \$1.90 to 2.20 per Lb.
 V Metal 90% \$3.30 to 3.50 per Lb. Ctd. V
 V Metal 95% \$3.40 to .45 per gram
 V Pent C.F. \$7.00 per Lb.
 AmnVan CP \$7.00 per Lb.
 SodVan \$3.90 to 2.20 per Lb.

Prices the same to all customers for similar quantities, sizes, on contract and spot basis. Special grinding and quality extras not indicated in above standard prices.

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VANADIUM CORPORATION OF AMERICA

Sales of Vanadium Ore, Flue Dust, Vanadic Acid (Vanadium Pentoxide), Ferro Vanadium and Price Ranges

Year - 1940

DOMESTIC

CUSTOMER	MATERIAL
Acme Steel & Mill Iron Works	FeV
Adirondack Foundries & Steel	FeV
Ahern Textile Print	Ann NVan
Ajax Electrothermic Corp.	FeV
Alan Wood Steel Co.	FeV
Allegheny Ludlum Steel Corp.	FeV
" " " "	V Pent.
Alley Steel & Metals Co.	FeV
Allyne-Ryan Foundry Co.	FeV
Altens Foundry & Machine Works	FeV
American Car & Foundry Co.	FeV
American Chain & Cable Co.	FeV
American Cyanamid & Chemical Co.	V Pent.
American Locomotive Co.	FeV
American Smelting & Refining Co.	V Pent.
" " " "	V Metal
American Steel Casting Co.	FeV
American Steel Foundries	FeV
Ansbacher-Siegle Corp.	Sod O Van
Babcock & Wilcox Co.	FeV
H. W. Balsley	V Ore
Bacsite Smelting Co.	FeV
Bell Telephone Lab.	FeV
" " " "	V Pent.
" " " "	V Pent. CP
Belmont Smelting & Refining Co.	FeV
" " " "	V Metal
Bethlehem Steel Co.	FeV
" " " "	V. Pent.
Blackson Chemical Co.	V Pent.
Bonney-Floyd Co.	FeV
Braceburn Alloy Steel Corp.	FeV
Braun Corp.	Ann NVan CP
Brewer & Co.	Ann NVan
Buffalo Co-op Stove Co.	FeV
Burnside Steel Foundry Co.	FeV
Calco Chemical Div.	V Pent
Calorizing Co.	FeV
Calumet Steel Castings Co.	FeV
Campbell Wyant & Cannon Mfg. Co.	FeV
Carbis Color & Chemical Co.	Ann NVan
Carborundum Co.	V Pent

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CUSTOMER

Carns Chemical Co.
 Catalytic Div. Co.
 Central Iron Fdry. Co.
 Champion Spark Plug Co.
 Chapman Valve Mfg. Co.
 Chicago Malleable Castings Co.
 City Chemical Co.
 Clark Equipment Co.
 Climax Molybdenum Corp.
 Sigmund Cohen
 Cold Spring Bleachery
 H. Cole Co.
 Colonial Steel Div.
 Columbia University
 Consolidated Chemical Industries
 Continental Roll & Steel Foundries
 Cook Ceramic Mfg. Co.
 Copperweld Steel Co.
 Corning Glass Works
 M. G. Carson
 Crane Co.
 Crobalt, Inc.
 Crucible Steel Cstg. Co.
 Crucible Steel Co. of America

Dake Engine Co.
 Morton Dennis Co.
 Detroit Alloy Steel Co.
 Detroit Gray Iron Fdry. Co.
 Detroit Steel Cstg. Co.
 Henry Diston & Sons, Inc.
 E. F. Drakenfeld & Co.
 E. I. DuPont de Nemours
 " " " "

Duraloy Co.
 Durey Plastics & Chemical Corp.

E. A. Laboratories MI.
 Eastman Kodak
 Edgewater Steel Co.
 Electric Steel Cast.
 Empire Steel Cast.
 Ensign Fdy.
 Erie Forge
 Etma Machine
 Fairmont Chem.
 Falk Corp.
 Faurot Protective System
 Ferro Enamel Corp.
 Foote Mineral Co.
 Forged Carbides Inc.
 Forging & Castings Co.
 Fort Pitt Steel Castings
 Fritsch Brothers

MATERIAL

V Pent.
 Sod O Van
 FeV
 V Metal
 FeV
 FeV
 V Pent.
 FeV
 FeV
 V Metal
 Ann NVan
 V Pent. CP
 FeV
 V Pent. CP
 V Pent.
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 V Metal
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 V Metal
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FeV
 Sod O Van
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 Ann NVan CP
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 V Pent.

V Pent.
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 V Metal
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 Sod O Van
 Ann Va
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 V Metal
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 FeV
 V Pent.

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CUSTOMER

General Axilline Works
General Chemical Co.

General Dyestuff Corp.
General Electric Co.

General Steel Casting Corp.
Gessing Chemical Company
Olivandon-Dalawanna, Inc.

Glover Machine Works
Gorham Tool Company
Grand Rapids Foundry
Great Lakes Steel Corp.
Gulf Research & Dev. Co.

Hampton Co.
Hannovia Chemical & Mfg. Co.
Charles Hardy, Inc.
Harrison Steel Castings Co.
Harshaw Chemical Co.
Hartford Electric Steel Corp.
Harvard University
Heil Corp.
Heppenstall Co.
Hobart Manufacturing Co.
Home Insurance Co.
Hudson Fur Dyeing, Inc.
Hytenail Aluminum Co.
Ingersoll Steel & Disc Div.

Inland Steel Co.
International Harvester Co., Inc.
Jackson & Church Co.
Jesseop Steel Co.
Jones & Laughlin Steel Corp.
Joslyn Mfg. & Supply Co.
Fred Kahl Iron Co.
Kensington Steel Co.
Keokuk Steel Castings Co.
Keystone Steel & Wire Co.
Kilby Steel Co.
The W. O. Larsen Fdy. Co.
Latrobe Electric Steel Co.
Lebanon Steel Foundry
Lindsey Light & Chemical Co.
Locomotive Finished Material Co.
Lukens Steel Company
A. D. Mackay

Machined Steel Casting Co.
P. R. Mallory & Co., Inc.
Marion Steam Shovel Co.
Mason Color & Chemical Works

MATERIAL

V Pent
FeV
V Pent
Ann M Van
Ann M Van
FeV
V Pent
FeV
V Pent
Ann M Van
V Pent
FeV
FeV
FeV
FeV
V Pent
90% V Metal
Ann M Van
90% V Metal
Ann M Van
Fe Van
V Pent
Fe Van
V Pent CP
Ann M Van CP
FeV
FeV
V Pent
Ann M Van
90% Van Metal
Fe V O N
Fe V Cru
Fe Van
Fe Van
Fe Van
Fe Van
Fe Van
Fe Van
Fe Van
Fe Van
Fe Van
Fe Van
Fe Van
Van Pent
Fe Van
Fe Van
90% Van Metal
95% Van Metal
Fe Van
Van Pent
Fe Van
Ann M Van

[fol. 106]

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CUSTOMER

Mass. Inst. of Technology
 Maynard Elec. Steel Casting Co.
 McNernay Chemical Corp.
 Mesta Machine Co.
 Metal Hydrides, Inc.
 Metal & Thermit Corp.
 Metallo-Chemical Corp.
 Michigan Steel Casting Co.
 Midvale Co.

Milwaukee Steel Fdry. Co.
 Monroe Steel Castings Co.
 Monsanto Chemical Co.
 Munning & Munning, Inc.
 Muskegon Piston Ring Co.
 National Aniline & Chemical Co.

National Forge & Ordnance Co.

Norwich Chemical Co.
 Ohio Steel Foundry Co.
 Paden City Pottery Co.

Parker Pen Co.

Penn Electric Steel Casting Co.
 Permutit Co.
 Peru Foundry Co.
 Phillips Dental Laboratory
 Pittsburgh Plate Glass Co.
 Pittsburgh Rolls Division
 Pohlman Foundry Co.
 Pratt & Letchworth Co.
 Proximity Manufacturing Co.
 Purdue University
 Red King Potterian, Inc.
 Reichhold Chemicals, Inc.
 Reilly Tar & Chemical Corp.
 Reliable Ink & Stationery Co.
 Reliance Steel Castings Co.
 Republic Steel Corp.
 Ross Machine Foundries
 Rotary Electric Steel Co.
 Rouse & Shearer, Inc.
 Saginaw Malleable Iron Div.
 E. H. Sargent Co.

Service Foundry Co.
 The Sharpes Solvents Corp.
 Simonds Saw & Steel Co.
 Sinclair-Valentine Co.
 Sirtex Printing Co.
 Sivyer Steel Casting Co.
 Walden A. Smith

MATERIAL

Van Pent
 Fe Van
 Ann M Van
 Fe Van
 Ann M Van CP
 Fe Van
 Van Pent
 Fe Van
 Fe Van O H
 Fe Van Cru
 Fe Van
 Fe Van
 Ann M Van CP
 Ann M Van
 Fe Van
 Van Pent
 Ann M Van
 Fe V O H
 Fe Van Pri
 Van Pent
 Fe Van
 Van Pent
 Ann M Van
 Ann M Van
 Sod O Van
 Fe Van
 Ann M Van
 Fe Van
 Fe Van
 Van Pent
 Fe Van
 Fe Van
 Fe Van
 Ann M Van
 Ann M Van
 Van Pent
 Van Pent
 Van Pent
 Ann M Van
 Fe Van
 Fe Van
 Fe Van
 Fe Van
 Van Pent
 Fe Van
 Van Pent
 Ann M Van
 Van Pent CP
 Fe V
 Ann M Van
 Fe Van Cru
 Sod O Van
 Ann M Van
 Fe Van
 Van Pent

[fol. 107]

— 3 —

CUSTOMER

Smith Steel Foundry Co.
Solvay Process Co.
Southern Bleachery & Print Works
Standard Elec. Steel Castings Co.
Standard Oil Co. of Calif.

Standard Oil Development Co.

Standard Steel Works Division

Frederick Stearns & Co.

J. L. Stifel & Sons, Inc.
Stuart Foundry Co.
Superior Foundry Co.
Swedish Crucible Steel Co.
Sydney-Could Corp.
Taylor Wharton Iron & Steel Co.
Textile Chemical Co.
Timken Roller Bearing Co.
Treadwell Engineering Co.
Joseph Turner & Co.

Tyconite Corp. of America
The Udylite Corp.
Union Spring & Mfg. Co.
Union Steel Castings
Unitcast Corp.
United Brass & Aluminum Co.
United Engineering & Foundry Co.
U. S. Fingerprint Products, Inc.
U. S. Steel Corp.
Universal Cyclone Steel Corp.

Valley Paint & Chemical Co.
Valley Steel Casting Co.
Vanadium-Alloyed Steel Co.
Verona Chemical Co.
Vulcan Crucible Steel Co.
Vulcan Iron Works
Waldrich Co.
Washburn Wire Company
W. M. Welch Mfg. Co.

West Michigan Steel Foundry Co.
West Steel Casting Co.
Will Corp.

Worth Steel Co.
Youngstown Foundry & Mach. Co.
Youngstown Sheet & Tube Co.
Zenith Foundry Co.
Zimmerman Steel Co.

MATERIAL

Pe Van
 Ann M Van
 Ann M Van
 Pe Van
 Ann M Van
 Sod O Van
 Van Pent
 Van Pent
 Van Pent CP
 Pe Van O H
 Pe Van Cru
 90% Van Metal
 Van Pent CP
 Ann M Van
 Pe Van
 Pe Van
 Pe Van
 Pe Van
 Ann M Van
 Pe Van
 Pe Van O H
 Van Pent
 90% Van Metal
 90% Van Metal
 95% Van Metal
 Pe Van
 Pe Van
 Pe Van Cru
 Pe Van O H
 Sod O Van
 Pe Van O H
 Pe Van O H
 Pe Van Cru
 Van Pent
 Ann M Van
 Pe Van O H
 Pe Van Cru
 Van Pent
 Pe Van Cru
 Pe Van O H
 Ann M Van
 Pe Van O H
 Ann M Van
 Van Pent CP
 Pe Van O H
 Pe Van
 Van Pent
 Ann M Van
 Pe V O H
 Pe V O H
 Pe V O H
 Pe Van O H
 Pe V O H

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CANADIAN

CUSTOMER
 Canadian Brake Shoe & Foundry Co.
 Consolidated Mining & Smelting
 Deloro Smelting & Refining Co., Ltd.
 Dominion Foundries & Steel, Ltd.

MATERIAL
 Fe Van
 Van Pent
 Van Metal
 Fe Van

1940 - DOMESTIC AND CANADIAN PRICE RANGES

Fe Van D H - \$2.70 to \$2.80 per lb. Ctd. V
 Fe Van Cru - \$2.80 to \$2.90 " " " "
 Fe Van Pri - \$2.90 to \$3.00 " " " "
 Van Pent - \$1.10 per lb. Ctd. V 20% to 1.25 per lb. nat'l
 Amm M Van - \$1.90 to 2.20 per lb.
 V Metal 90% - \$3.30 to 3.50 per lb. Ctd. V
 V Metal 95% - \$0.40 to \$0.45 per gram
 V Pent C P - \$7.00 per lb.
 Amm M Van C P - \$7.00 per lb.
 Sod O Van - \$0.90 to \$2.20 per lb.

Prices the same to all customers for similar quantities,
 sizes on contract and spot basis. Special grinding and
 quality extras not indicated in above standing prices.

VANADIUM CORPORATION OF AMERICA

SALES OF VANADIUM ORE, FLUE DUST, VANADIC ACID (VANADIUM PENTOXIDE & FERRO VANADIUM
AND PRICE BOOKS)
YEAR - 1941

DOMESTIC

<u>Customer</u>	<u>Material</u>
Abbott Laboratories	Ann M Van CP
Acme Foundry Co.	Fe. V
Adirondack Foundries & Steel	Fe. V
Aetna-Standard Eng. Co.	Fe. V
Ahern Textile Print	Ann M Van
Dean Wood Steel Co.	Fe. V
Allegheny Ludlum Steel Corp.	Fe. V
"	V. Pent.
Allied Textile Printers	Ann M Van
Altens Foundry & Machine Co.	Fe. V
American Car & Foundry Co.	Fe. V
American Chain & Cable Co.	Fe. V
American Cyanamid & Chem. Co.	V. Pent.
American Electro Metal Corp.	V. Metal
American Locomotive Co.	Fe. V
American Smelting & Refining Co.	V. Pent.
American Steel Foundries	Fe. V
Apex Foundry Co.	Fe. V
Apponaug Co.	Ann M Van
Arnold Print Works	Ann M Van
Auto Specialties Mfg. Co.	Fe. V
Babcock & Wilcox Co.	Fe. V
J. T. Baker Chemical Co.	V. Pent.
Barrett Co.	V. Pent.
Bell Telephone Laboratories	Fe. V
J. & H. Berge	Ann M Van
Berg Chemical Co.	Ann M Van
Bethlehem Steel Co.	Fe. V
"	V. Pent.
Bonney-Floyd Co.	Fe. V
Braeburn Alloy Steel Corp.	Fe. V
Burnside Steel Foundry Co.	Fe. V
Burt Foundry Co.	Fe. V
A. M. Byers Co.	Fe. V
Calco Chemical Div.	V. Pent.
Calumet Steel Castg. Corp.	Fe. V
Campbell Wyant & Cannon Mfg. Co.	Fe. V
Carbic Color & Chem. Co.	Ann M Van
Carborundum Co.	V. Pent.
Carnegie Institute of Tech.	Fe. V
Carus Chemical Co.	V. Pent.
Central Iron Foundry	Fe. V
Central Scientific Co.	V. Pent.
	Sod O Van
Chapman Valve Mfg. Co.	Fe. V
Chicago Steel & Wire Co.	Fe. V
Chrysler Corp.	Fe. V
City Chemical Co.	V. Pent.
Clafin Co.	Ann M Van CP
Clark Equipment Co.	Fe. V

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1941

<u>Customer</u>	<u>Material</u>
Climax Molybdenum Corp.	Fe. V
Cold Spring Bleachery	Arm M Van
M. Cole Co.	V. Pent CP
Coleman & Bell Co.	V. Pent.
Colonial Steel Div.	Fe. V
Columbia University	V. Pent.
Consolidated Chem. Industries	V. Pent.
Continental Finger Print Prod.	Sod O Van
Continental Roll & Steel Fdry.	Fe. V
Copperweld Steel Co.	Fe. V
Crobolt Inc.	V. Metal
Crucible Steel Cast. Co.(Mil)	Fe. V
Crucible Steel Co. of Amer.	Fe. V
"	V. Pent.
A. Daigger & Co.	V. Metal
Davis & Geck Inc.	V. Metal
Dayton Steel Foundry Co.	Fe. V.
Dentalium Labs.	V. Metal
Detroit Alloy Steel Co.	Fe. V
Detroit Steel Cast. Co.	Fe. V
Henry Diston & Sons	Fe. V
Doonan & Smith Chemical Co.	Arm M Van
B. F. Drakenfeld & Co.	V. Pent.
E. I. DuPont de Nemours	V. Pent.
"	Arm M Van CP
Duraloy Co.	Fe. V
E. A. Laboratories	V. Pent.
Elmer & Amend	V. Pent.
Electric Steel Cast. Co.	Fe. V
Electrocast Steel Fdry. Co.	Fe. V
Empire Ordnance Corp.	Fe. V
Ensign Foundry Co.	Fe. V
Erie Forge Co.	Fe. V
Erie Forge & Steel Co.	Fe. V
Etna Machine Co.	Fe. V
Fairmount Chemical Co.	V. Metal
Falk Corp.	Fe. V
Faurat Prat & Iden System	Sod O Van
Ferro Channel Co.	Arm M Van
Ferro Mach. & Fdry. Co.	Fe. V
Follansbee Steel Corp.	Fe. V
Foots Mineral Co.	V. Pent.
Ford Motor Co.	Fe. V
Forging & Cast. Corp.	Fe. V
Fort Pitt Steel Cast. Co.	Fe. V
Frenchtons Porcelain Co.	V. Pent.
"	V. Pent. CP
Geigg Co.	Arm. M Van
Gelatin Products Co.	V. Pent CP
General Aniline Works	V. Pent.
General Chemical Co.	V. Pent.
"	V. Pent CP
General Dyestuff Corp.	Arm M Van
General Electric Co.	Fe V
"	V. Metal
General Steel Casting Corp.	Fe. V
Gorham Tool Co.	Fe V
Great Lakes Steel Corp.	Fe V

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1941

<u>Customer</u>	<u>Material</u>
Nall China Co.	V. Pent.
Hampton Co.	Arm M Van
Charles Hardy Inc.	V. Metal
Harrison Steel Cast. Co.	Fe. V
Harshaw Chemical Co.	V. Pent.
Hartford Electric Steel Corp.	Fe. V
Heading Inc.	Arm M Van
Neil Corp.	V. Pent.
Neppenstall Co.	Fe. V
Heyden Chemical Corp.	V. Pent.
" "	V. Pent CP
" "	V. Pent.
Hilton-Davies Chemical Co.	Fe. V
Hobart Mfg. Co.	V. Pent.
O. Hommel Co.	Arm M Van
Hudson Fur Dyeing	Fe. V
Hughes Tool Co.	V. Metal
Hytensil Aluminum Co.	Fe. V
Ingersoll Steel & Disc Div.	Fe. V
Inland Steel Co.	V. Pent.
Insecticide Corp. of Amer.	Fe. V.
International Harvester Co.	V. Pent.
Interstate Laboratories	Fe. V
Jessop Steel Co.	Fe. V
Jones & Laughlin Steel Corp.	Fe. V
Joelyn Mfg. & Supply Co.	Fe. V
Frederick Kahl Iron Co.	Fe. V
Kali Mfg. Corp.	Arm M Van
Kearny Mfg. Co.	Sod M Van CP
Kensington Steel Co.	Fe. V
Keokuk Steel Castings Co.	Fe. V
Knoxville Iron Co.	Fe. V
Laboratory Materials Co.	Sod M Van
Lafrore Elec. Steel Co.	Fe. V
Lebanon Steel Foundry	Fe. V
LeTourneau Co. of Georgia	Fe. V
Lett & Co.	Fe. V
Lewis Co.	Arm M Van
Lewis Foundry & Mach. Div.	Fe. V
Lima Locomotive Works	Fe. V
Link Belt Co.	Fe. V
Locomotive Fin. Material Co.	Fe. V
Lukens Steel Co.	Fe. V
Lynchburg Foundry Co.	Fe. V
A. D. Mackay	V. Metal
Machined Steel Cast. Co.	Fe. V
P. R. Mallory & Co. Inc.	V. Pent.
Marion Steam Shovel Co.	Fe. V.
Mason Color & Chem Wks.	V. Pent.
Mass. Inst. of Tech.	Fe. V
Massillon Steel Cast. Co.	Fe. V
Maynard Elec. Steel Cast. Co.	Fe. V
McArthur Chem. Co.	Arm M Van
McKesson & Robbins Inc.	V. Pent.
Wm. S. Merrill Co.	V. Pent.
Meets Machine Co.	Fe. V
Metal & Thermit	Fe. V
Michigan Steel Casting Co.	Fe. V

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←
1941

<u>Customer</u>	<u>Material</u>
Midvale Co.	Fe. V
"	V. Metal
"	Fe. V
Milwaukee Steel Fdry. Co.	Fe. V
Monroe Steel Cast. Co.	Fe. V
Motor Castings Co.	Fe. V
Motor & Machinery Cast. Corp.	Fe. V
Muskegon Piston Ring	Fe. V
Nat'l Aniline & Chem. Co.	V. Pent.
	Ann M Van
Nat'l Forge & Ord. Co.	Fe. V
Nat'l Mall. & Steel Cast. Co.	Fe. V
Nat'l Supply Co.	Fe. V
Newport News Ship & Drydock	Fe. V
N. Y. Quinine & Chem. Works	Ann M Van CP
Nobilium Products, Inc.	V. Metal
Northwestern Univ.	V. Pent CP
Ohio Steel Foundry Co.	Fe. V
Oklahoma Steel Cast. Co.	Fe. V
Omaha Steel Works	Fe. V
Paden City Pottery Co.	Ann M Van
Parker Pen Co.	Ann M Van
Pelton-Kurtz Supply Co.	Fe. V
Penn. Elec. Steel Cast. Co.	Fe. V
Penn. State College	V. Pent.
	V. Metal
The Permutit Co.	Ann M Van
Peru Fdry. Co.	Fe. V
Pittsburgh Steel Co.	Fe. V
Red Wing Pottery Co.	V. Pent.
Reichhold Chemicals, Inc.	V. Pent.
	Ann M Van
Reliable Ink & Stationery Co.	Ann M Van
Reliance Steel Cast. Co.	Fe. V
Republic Chemical Corp.	V. Pent.
Republic Steel Corp.	Fe. V
	V. Pent.
Riley Stoker Corp.	Fe. V
Robinson-Ramsbottom Pottery	Ann M Van
Ross Meehan Fdries.	Fe. V
Rotary Elec. Steel Corp.	Fe. V
Saginaw Metal Products Co.	Fe. V
St. Louis Steel Cast. Co.	Fe. V
E. H. Sargent Co.	V. Pent.
	Ann M Van
	Ann M Van CP
Saubrook Steel Castings	Fe. V
Scientific Glass App. Co.	V. Pent.
	Ann M Van
Scurlock Littman Eng. Ass.	Fe. V
Sealkote Corp.	V. Pent.
Shamokin Dye & Print Works	Ann M Van
The Sharples Solvents Corp.	V. Pent.
	Ann M Van
	Ann M Van CP
Simonds Saw & Steel Co.	Fe. V
Sirtex Printing Co.	Ann M Van
Sivyer Steel Cast. Co.	Fe. V
A. O. Smith Corp.	Fe. V

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1941

<u>Customer</u>	<u>Material</u>
Smith Steel Fdry. Co.	Fe. V
Spencer Heater Div.	Fe. V
Standard Elec. Steel Cast.	Fe. V
Standard Oil Co. of Calif.	Ann M Van
Standard Oil Co. of La.	Ann M Van
Standard Oil Development Co.	V. Pent. CP
	V. Pent. CP
	Ann M Van CP
Standard Steel Works, Div.	Fe. Van.
Standard Ultramarine	V. Pent.
Stauffer Chem. Co.	V. Pent.
Sterling Steel Cast. Co.	Fe. V
J. L. Stifel & Sons, Inc.	Ann M Van
Stoody Co.	Fe. V
Stuart Foundry Co.	Fe. V
Superior Steel & Mall. Cast.	Fe. V
Swansea Print Works	Ann M Van
Swedish Crucible Steel Co.	Fe. V
Symington-Gould	Fe. V
Taylor-Wharton Iron & Steel	Fe. V
Technical Porcelain & C.W.Co.	V. Pent.
Textile Chemical Co.	Ann. M Van
Timken Roller Bearing Co.	Fe. V
Titanium Alloy Mfg. Co.	V. Pent.
Treadwell Eng. Co.	Fe. V
Union Elec. Steel Corp.	Fe. V
Union Sprg. & Mfg. Co.	Fe. V
Union Steel Cast.	Fe. V
Unitcast Corp.	Fe. V
United Brass & Alum. Co.	Fe. V
U. S. Fingerprint Prod.	Sod O Van
U. S. Foundries	Fe. V
U. S. Steel Corp.	Fe. V
Univ.-Cyclope Steel Corp.	Fe. V
	V. Pent.
	V. Pent.
The Upjohn Co.	Fe. V
Valley Steel Cast. Co.	Fe. V
Vanadium Alloys Steel Corp.	V. Pent.
Verona Chemical Co.	V. Pent.
Vulcan Crucible Steel Co.	Fe. V
" " "	Fe. V
Vulcan Iron Works	Ann M Van
Waldrich Co.	V. Pent.
Geo. T. Walker & Co.	Ann M Van
" " "	Ann M Van CP
" " "	Fe. V
Washburn Wire Co.	Ann M Van
W. M. Welch Mfg. Co.	Fe. V
West Mich. Steel Fdry.	Fe. V
West Steel Cast. Co.	Fe. V
Westinghouse Elec. & Mfg. Co.	Fe. V
Wilkening Mfg. Co.	Fe. V
Worth Steel Co.	Fe. V
Youngstown Fdry. & Mash. Co.	Fe. V
Youngstown S & T Co.	Fe. V
Zenith Foundry Co.	Fe. V
R. M. Zerby	V. Pent.

1941

CANADIAN

Atlas Steel Ltd.
Canadian Brake Shoe & Fdry. Co.
Consolidated Mining & Smelt. Co.
Dominion Foundries & Steel Ltd.
Dominion Tar & Chem. Co.

Metallurgical
Fe. V
Fe. V
V. Pent.
Fe. V
Ann M Van

1941 Domestic and Canadian Price Ranges

Fe. VCH	\$2.70 to 2.80 per lb. Ctd. V
Fe. V Gra.	2.80 to 2.90 " "
Fe. V Fri.	2.90 to 3.00 " "
V. Pent.	1.10 per lb. Ctd. V205 to 1.25 per lb. Natl.
Ann M. Van	1.90 to 2.20 per lb.
V. Metal 90%	3.30 to 3.50 per lb. Ctd. V
V. Metal 95%	.40 to .45 per gram
V. Pent. GP	7.00 per pound
Ann. M. Van GP	7.00 per pound
Sed. O Van	.90 to 2.20 per pound

Prices the same to all customers for similar quantities, sizes - on contract and spot bases. Special grinding and quality surces not indicated in above standard prices.

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VANADIUM CORPORATION of AMERICA
Sales of Vanadium Ore, Flue Dust, Vanadic Acid
(Vanadium Pentoxide) & Ferro Vanadium
and Price Ranges
YEAR - 1942

Domestic

<u>CUSTOMER</u>	<u>Material</u>
Abbott Laboratories	Van Pent CP
Advance Foundry Co.	Fe V
Acme Steel & Malleable Iron Works	"
Adirondack Foundries & Steel, Inc.	"
The Aetna-Standard Eng. Co.	"
Ahern Textile Print	Ann M Van
Alan Wood Steel Co.	Fe V
Allegheny Ludlum Steel Corp.	"
" " " "	Van Pent
Allies Foundry Products, Inc.	Fe V
American Cyanamid & Chemical Co.	Van Pent
American Locomotive Co.	Fe V
American Rolling Mill Co.	Fe V
American Smelting & Refining Co.	Van Pent
American Steel Foundries	Fe V
American Well & Prosp. Co.	Fe V
Atlas Steels, Ltd.	Fe V
Babcock & Wilcox Co.	Fe V
J. T. Baker Chemical Co.	Ann M Van
Bass Foundry & Machine Divn.	Fe V
Bell Telephone Lab.	Van Metal
Bethlehem Steel Co.	Fe V
" " " "	Van Pent
Bonney Floyd Co.	Fe V
Braeburn Alloy Steel Corp.	Fe V
Braun Corp.	Ann M Van CP
Brocker Chemical Co.	Van Pent
Bucyrus Erie Co.	Fe V
Burnside Steel Foundry Co.	Fe V
A. M. Byers Co.	Fe V
Carbic Color & Chemical Co.	Ann M Van
Carns Chemical Co., Inc.	Van Pent
Celanese Corp. of America	" "
Chapman Valve Manufacturing Co.	Fe V
Chicago Steel & Wire Co.	Fe V
Ciba Co., Inc.	Van Pent
Cold Spring Bleachery	Ann M Van
H. Cole Co.	Van Pent CP
The Coleman & Bell Co., Inc.	Van Pent
The Colonial Foundry Co.	Fe V
Colonial Steel Co.	Fe V
Consolidated Chemical Industries, Inc.	Van Pent

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Domestic

YEAR 1942 - Page 2

<u>CUSTOMER</u>	<u>Material</u>
Continental Roll & Steel Foundry Co.	Fe V
Copperweld Steel Co.	Fe V
Crobbett, Inc.	V Metal
Crucible Steel Co. of America	Fe V
" " " "	Van Pent
Henry Disston & Sons, Inc.	Fe V
" " " "	Van Pent
E. I. Du Pont de Nemours & Co.	Ann M Van CP
The Duraloy Co.	Fe V
E. A. Laboratories, Inc.	Van Pent
Eiser & Amend	" "
Electric Boat Co.	Ann M Van
Electric Steel Castings Co.	Fe V
Electrocast Steel Foundry Co.	Fe V
Empire Ordnance Co.	Fe V
Ensign Foundry Co.	Fe V
Erie Forge	Fe V
Erie Forge & Steel Co.	Fe V
Falk Corp.	Fe V
Faurot Protective & Identification Sys.	Sed Van
Ferro Khamel Corp.	Ann M Van
Firth-Sterling Steel Co.	Fe V
Follansbee Steel Corp.	Fe V
Ford Motor Co.	Fe V
Forging & Casting Corp.	Fe V
General Color & Chemical Co.	Van Pent
" " " "	Ann M Van
General Dyestuff Corp.	Ann M Van
Gorham Tool Co.	Fe V
Small Greinle Co.	Ann M Van
Charles Hardy, Inc.	V Metal
Harrison Steel Castings Co.	Fe V
Marshall Chemical Co.	Van Pent
Harvard University	Van Pent CP
Heppenstall Co.	Fe V
O. Hommel Co.	Van Pent
Myersall Aluminum Co.	V Metal
Ingersoll Steel & Disc. Divn.	Fe V
Inland Steel Co.	Fe V
International Harvester Co., Inc.	Fe V

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Domestic

YEAR 1942 - Page 3

CUSTOMER

Jessop Steel Co.
 Jones & Laughlin Steel Co.
 Frederick Kahl Iron Co.
 M. M. Kellogg Co.
 Latrobe Electric Steel Co.
 Lebanon Steel Foundry
 Lewis Co.
 Lukens Steel Co.
 A. D. Mackay
 Machined Steel Casting Co.
 Mason Color & Chemical Works
 Master Mix Paint & Lacquer Corp.
 Maynard Elec. Steel Castings Co.
 Mesta Machine Co.
 Metal & Thermit Corp.
 Michigan Steel Castings Co.
 Midvale Co.
 Monroe Steel Castings Co.
 Napco, Inc.
 Nathan Chemical Co.
 National Aniline Divn.
 " " "
 " " "
 National Bureau of Standards
 National Forge & Ordnance
 National Lead Co.
 National Malleable & Steel Castings Co.
 National Supply Co.
 Newport News Shipbuilding & Drydock Co.
 Nixon Nitration Works
 Nobilium Products, Inc.
 Ohio Steel Foundry Co. (Springfield, Ohio)
 Osalid Products Divn.
 Parker Pen Co.
 The Patterson Screen Co.
 Penn Electric Steel Castings Co.
 Pittsburgh Plate Glass Co.
 Rayrex Printers, Inc.
 RCA Manufacturing Co.
 Kelly Tar & Chemical Corp.
 " " "
 " " "
 Republic Steel Corp.
 " " "
 " " "
 Rhode Island State College
 Rotary Electric Steel Co.
 E. M. Sargent Co.
 " " "
 " " "
 " " "

Material

Fe V
 Fe V
 Fe V
 Ann M Van
 Fe V
 Fe V
 Fe V
 Ann M Van
 Fe V
 V Metal
 Fe V
 Ann M Van
 Sod M Van
 Fe V
 Fe V
 Van Pent CP
 Fe V
 Fe V
 Fe V
 Fe V
 Van Pent
 Van Pent
 Ann M Van
 Ann M Van
 Fe V
 Sod M Van
 Fe V
 Fe V
 Fe V
 Van Pent
 V Metal
 Fe V
 Ann M Van
 Ann M Van
 Van Pent CP
 Fe V
 Van Pent
 Ann M Van
 Van Pent CP
 Ann M Van CP
 Van Pent CP
 Fe V
 V Pent
 Ann M Van CP
 Fe V
 Van Pent
 Van Pent CP
 Ann M Van CP

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Domestic

YEAR 1942 - Page 4

CUSTOMERMaterial

Shell Development Co.
 Sherwin Williams Co.
 Simonds Saw & Steel Co.
 Sirtex Printing Co.
 George F. Smith
 Solar Aircraft Co.
 Standard Electric Steel Castings Co.
 Standard Steel Works Co.
 Standard Ultramarine Co.
 Stauffer Chemical Co.
 Sterling Steel Casting Co.
 The Stoddy Co.
 Superior Steel & Malleable Castings Co.
 Textile Chemical Co.
 Timken Roller Bearing Co.
 " " "
 Tinnite Co.
 Treadwell Engineering Co.
 Union Electric Steel Corp.
 Union Steel Castings
 Unitcast Corp.
 United Brass & Aluminum Co.
 U.S. Fingerprint Products, Inc.
 U.S. Foundries, Inc.
 U.S. Steel Corp.
 " " "
 Universal-Cyclops Steel Corp.
 " " "
 University of Pittsburgh
 Valley Steel Castings Co.
 Vanadium Alloys Steel
 Vulcan Crucible Steel Co.
 " " "
 Waldrich Co.
 George T. Walker
 " " "
 T. F. Washburn Co.
 Washburn Wire Co.
 West Steel Castings
 Westinghouse Elec. & Mfg. Co.
 Wilkens Anderson Co.
 Worth Steel Co.

Van Pent
 Ann M Van
 Fe V
 Ann M Van
 Van Pent
 Van Pent CP
 Fe V
 Fe V
 Van Pent
 Van Pent
 Fe V
 Fe V
 Fe V
 Ann M Van
 Fe V
 Van Pent
 Fe V
 Fe V
 Fe V
 Fe V
 Sod Van
 Fe V
 Fe V
 V Pent
 V Pent
 Fe V
 Ann M Van
 Fe V
 Fe V
 Fe V
 Van Pent
 Ann M Van
 Ann M Van
 Ann M Van CP
 V Pent CP
 Van Pent
 Fe V
 Fe V
 Fe V
 Sod Van
 Fe V.

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Domestic

YEAR 1942 - Page 3

CUSTOMERMaterial

Youngstown Foundry & Machine Co.
Zenith Foundry Co.
A. M. Lerby

Fe V
Fe V
Van Pent

Canadian

The Consolidated Mining & Smelting
Belore Smelting & Refining Ltd.
Dominion Foundries & Steel Ltd.
Dominion Tar & Chemical Co.
McArthur Chemical Co., Ltd.

Van Pent
V Metal
Fe V
Ann M Van
Ann M Van

1942 Domestic & Canadian Price ranges

Fe V - OH -	\$2.70 to \$2.80	per Lb Ctd Van
Fe V - Cru -	2.80 " 2.90	" " " "
Fe V - Pri -	2.90 " 3.00	" " " "
V Pent -	1.10 per Lb Ctd V ₂ O ₅	to \$1.25 per LB material
Ann M Van -	1.90 to 2.20	per Lb
V Metal 90% -	3.30 " 3.50	" " Ctd V
V Metal 95% -	.40 " .45	" gram
V Pent CP -	7.00	per Lb
Ann M Van CP -	7.00	" "
Sod Van -	.90 to 2.20	per Lb

Prices the same to all customers for similar quantities,
size - on contract and spot bases. Special grinding and
quality extra not indicated in above standard prices.

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VANADIUM CORPORATION OF AMERICA

Sales of Vanadium Ore, Fluor Dust, Vanadic Acid (Vanadium Pentoxide), Ferro Vanadium and Price Ranges

YEAR 1943

DomesticCUSTOMER

A. C. Spark Plug Div.
Actars, Inc.
Adirondack Foundries & Steel
Allegheny Ludlum Steel Corp.

Allis Chalmers Mfg. Co.
American Cyanamid Co.
American Enka Corp.

American Hoist & Derrick Co.
American Locomotive Co.
American Smelting & Refining Co.
Apex Chemical Co.
Apponaug Co.
Armstrong Cork Co.

Baker & Co.
J. T. Baker Chemical Co.
Barnaby-Cheney Engineering Co.
Bell Telephone Laboratories
Bethlehem Steel Co.
B. G. Corp.
Bonney-Floyd Co.
Bonnet Co.
Borden & Remington Co.
Brasburn Alloy Steel Corp.
Braun-Knecht Neiman Co.

A. M. Byers Co.
Carbis Color & Chemical Co.
Carus Chemical Co., Inc.
Central Iron Foundry Co.
Central Scientific Co.

Chemstar, Inc.
Chicago Foundry Co.
City Chemical Co.
Clark Equipment Co.
M. Cole Co.
Combustion Engineering Co., Inc.
Commercial Solvents Corp.
Continental Roll & Steel Co.

MATERIAL

V Pent
FeV
FeV
FeV
V Pent.
FeV
V Pent
AmM Van
AmM Van CP
FeV
FeV
V Pent.
V Pent.
AmM Van
V Pent CP

V Metal
AmM Van CP
V Pent
FeV
FeV
V Pent.
FeV
FeV
AmM Van
FeV
V Pent CP
V Pent
FeV
AmM Van
V Pent
FeV
Sod M Van
Sod M Van Comm.
Sod O. Van
FeV
V Pent
FeV
V Pent CP
V Pent
V Pent
FeV

7090

120

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CUSTOMER

Copperweld Steel Co.
Crane Co.
Crobalt, Inc.
Crucible Steel Co. of America
W. H. Curtin & Co.

Denver Fire Clay Co.
Dickson Gun Plant
Henry Dieston & Sons
Dow Chemical Co.
E. I. DuPont de Nemours

Dye Specialties Corp.

Eastman Kodak Co.
Elmer & Amend
Eul Engle
Empire Ordnance Corp.
Erie Forge Co.
Erie Forge & Steel Co.
Faurot Protective System
Foote Mineral Co.
Ford Motor Co.

Forging & Casting Corp.
Franchi Brothers
General Engine Works

General Dyestuff Corp.
G. W. Gesing
Gorham Tool Co.

Hampton Co.
Hansell-Elcock Co.
Charles Hardy, Inc.

Harshaw Chemical Co.

Heil Corp.

Heppenstall Co.
O. Hommel Co.

Ingersoll Steel & Dies Div.

Jessop Steel Co.
Jones & Laughlin Steel Corp.

Killian Research Laboratories
Kolsman Instr. Div.

MATERIAL

FeV
FeV
V Metal
FeV
ArmM Van CP

V Pent
FeV
FeV
V Pent
ArmM Van
ArmM Van CP
V Pent
ArmM Van
ArmM Van CP
V Pent
ArmM Van

FeV
FeV
FeV
Sod O Van
V Pent
FeV
V Pent
FeV
V Pent
V Pent
ArmM Van
ArmM Van
V Metal
FeV

ArmM Van
FeV
V Metal
FeV
ArmM Van CP
V Pent CP
V Pent
Sod M Van
V Pent
FeV
V Pent
Arm M Van

FeV

FeV
FeV

Sod MVan CP
V Pent

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<u>CUSTOMER</u>	<u>MATERIAL</u>
Latrobe Electric Steel Co.	FeV
Lehigh University	V Pent.
Lukens Steel Co.	FeV
A. D. MacKay	V Metal
Malleable Iron Fittings Co.	FeV
Mallinckrodt Chemical Works	V Pent.
Mason Color & Chemical Works	AmM Van
Mesta Machine Co.	FeV
Metal & Thermit Corp.	FeV
Midvale Co.	FeV
Milwaukee Steel Foundry Co.	FeV
Mine & Smelters Supply Co.	V Pent CP
	AmM MVan CP
	FeV
Muskegon Piston Ring Co.	
National Aniline Co.	V Pent
	AmM Van
National Forge & Ordnance Co.	FeV
Naugatuck Chemical Div.	V Pent
Newport News Shipbuilding & Dry Dock Co.	FeV
Niagara Alkali Co.	V Metal
Niagara Falls Smelting Corp.	V Metal
Niagara Sprayer Co.	V Pent
Nobilium Products, Inc.	V Metal
Nu-Ballium, Inc.	V Metal
Ohio Steel Foundry Co.	FeV
E. Dewitt Osborne	AmM MVan
Otis Elevator Co.	FeV
Pacific Vanasit Co.	ALV
Pan American Alloys, Inc.	ALV
Pa. Electric Steel Castings Co.	FeV
Pa. State College	V Metal
Penn Rivet Corp.	V Metal
Phillips Petroleum Co.	V Pent
	V Pent CP
	Sod O Van
	AmM MVan CP
	FeV
Pittsburgh Rolls Div (Blaw Knox Co.)	
Raw Chemicals, Inc.	V Pent
RCA Victor Div. of RCA	V Metal
Reduction & Refining Co.	V Pent CP
Reichhold Chemicals, Inc.	V Pent
Reliable Ink & Stationery Co.	AmM Van
Reliance Steel Castings Co.	FeV
Reproduction Products Co.	V Pent
Republic Steel Corp.	FeV
Reynolds Metals Co.	ALV
Roemer Drug Co.	V Pent CP
Rotary Electric Steel Co.	FeV

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CUSTOMER

Rotomet Corp.
Rustless Iron & Steel Co.

Saginaw Malleable Iron Div.
Scientific Glass Apparatus Co.
E. H. Sargent Co.
Simonds Saw & Steel Co.
Sirtex Printing Co.
Standard Electric Steel Ctg. Co.
Standard Steel Works Co.
Standard Oil Development Co.

Standard Ultramarine Co.
Stauffer Chemical Co.
Sterling Steel Casting Co.
Stoody Co.
Strong Cobb & Co.
Strong Steel Foundry Co.
Sylvania Electric Products

Textile Chemical Co.
Timken Roller Bearing Co.
Titanium Alloy Mfg.
The Tredegar Co.
Tungsten Alloy Mfg.

Union Electric Steel Corp.
Union Steel Castings Div.
United Brass & Aluminum Co.
U. S. Steel Corp.
Universal Cyclops Steel Corp.

University of California
University of Florida
University of Pittsburgh

Valley Steel Casting Co.
Vanadium Alloys Steel Co.

Vulcan Crucible Steel Co.
Waldrick Co.
Geo. T. Walker & Co.
Wall-Colomony Corp.
Wallwork Foundry Co.
Warren Foundry & Pipe Corp.

MATERIAL

FeV
FeV

FeV
ArmM Van
V Pent
FeV
ArmM Van
FeV
FeV
ArmM Van CP
ArmM Van
V Pent
V Pent CP
V Pent
V Pent
FeV
FeV
V Pent
FeV
ArmM Van
V Pent
ArmM Van CP
V Pent CP

Arm MVan
FeV
V Pent
FeV
V Metal

FeV Cru
FeV
FeV
FeV
V Pent
FeV
Y Metal
Arm M Van
V Pent
Arm MVan CP
FeV
FeV
V Metal
FeV
Arm MVan
Arm MVan CP
V Pent
FeV
FeV

[fol. 124]

-5-

CUSTOMER

Washburn Wire Co.
 West Steel Casting Co.
 Westinghouse Electric & Mfg.
 Wall Corp.

MATERIAL

FeV
 FeV
 FeV
 V Metal
 Amm M Van

CANADIANCUSTOMER

Deloro Smelting & Refining Co.
 Electrometallurgical Co. of Canada

MATERIAL

V Metal
 FeV

1943 DOMESTIC & CANADIAN PRICE RANGES

FeVOH	\$2.70 to 2.80 per lb. std. V
FeV Cru	2.80 to 2.90 " " " "
FeV Pri	2.90 to 3.00 " " " "
V Pent	1.10 per lb. std V205 to 1.25 per lb. matl.
Amm M Van	1.90 to 2.20 per pound
V Metal 90%	3.30 to 3.50 per lb. std. V
V Metal 94%	.40 to .45 per gram
V Pent CP	7.00 per pound
Amm M Van CP	7.00 " "
Sod O Van	.90 to 2.20 per pound

Prices the same to all customers for similar quantities, sizes - on contract and spot bases. Special grinding and quality extras not indicated in above standard prices.

[fol. 125]

VANADIUM CORPORATION OF AMERICASales of Vanadium Ore, Flue Dust, Vanadic Acid
(Vanadium Pentoxide) and Ferro Vanadium

and Price Ranges

DomesticYEAR 1944Page 1

<u>CUSTOMER</u>	<u>MATERIAL</u>
Artare, Inc.	FeV
Adirondack Pdries & Steel Co.	"
Air Reduction Sales Co.	V Pent CP
Alan Wood Steel Co.	FeV
Allegheny-Ludlum Steel Corp.	"
	V Pent
Allie Chalmers Mfg. Co.	FeV
Alten's Foundry & Machine Co.	"
Aluminum Co. of America	Ann M Van
	So Van
Aluminum Forgings, Inc.	V Metal
American Cyanamid & Chem. Co.	V Pent
American Fdry. Equipment Co.	FeV
American Locomotive Co.	"
American Viscose Corp.	AnnM Van CP
American Well & Prospecting Co.	FeV
Arcrods Corp.	"
Baker & Co.	V Metal
J. T. Baker Chem. Co.	AnnM Van CP
	V Pent CP
	V Pent
Barrett Co.	"
Batelle Memorial Inst.	"
Bay State Abrasive Prod. Co.	V Metal
Belmont Smelt. & Ref. Co.	Fe V
Bethlehem Steel Co.	V Pent.
	"
Braun Corp.	FeV
Brown Industries	AnnM Van
Buffalo Apparatus Co.	FeV
Brunside Steel Fdry. Co.	AnnM Van
Eurrell Tech. Supply Co.	FeV
Eurt Foundry Co.	"
A. M. Byers Co.	"
Calif. Research Co.	"
	Ann M Van
	AnnM Van CP
	V Pent
	V Pent CP
	V Metal
Campbell Wyant & Cannon Fdy. Co.	FeV
Carbic Color & Chem. Co.	AnnM V
Carbide & Carbon Chem. Corp.	AnnM Van CP
Carus Chemical Co.	V Pent

[fol. 126]

DomesticYEAR — 1944Page 2

<u>CUSTOMER</u>	<u>MATERIAL</u>
Case Mfg. Co., Wm. A. & Son	V Pent
Central Iron Foundry	FeV
Chapman Valve Mfg. Co.	"
Chemstar, Inc.	V Pent CP
Chemical Product Corp.	V Pent
Chemo Pure Mfg. Co.	V Pent CP
City Chemical Co.	So Van
Clark Equipment Co.	FeV
Climax Molybdenum Corp.	V Metal
Sigmond Cohn Co.	FeV
Cold Spring Bleachery	Arm M Van
H. Cold Co.	V Pent CP
Coleman & Bell Co.	V Pent
Colonial Foundry Co.	FeV
Colonial Steel Div.	"
Combustion Engineering Co.	V Pent
Continental Fdry. & Mach. Co.	FeV
Copperweld Steel Co.	"
Corning Glass Works	V Pent
Crucible Steel Cast. Co. (Mil.)	FeV
Crucible Steel Co. of America	"
Dareis Emergency Equipment Co.	V Metal
Dehydro-Co.	V Pent
	V Pent CP
	FeV
	V Metal
	FeV
	"
Dickson Gun Plant	Sod O Van
Henry Disston & Sons, Inc.	V Pent
Low Chemical Co.	ArmM Van CP
H. F. Drakenfeld Co.	V Pent
Drug Products, Inc.	V Pent CP
E. I. DuPont Nemours	ArmM Van
	ArmM Van CP
	So Van
Eagle Grinding Wheel Co.	V Pent
Eastman Kodak Co.	ArmM Van
Eimer & Amend Co.	V Pent
Electric Auto Lite Co.	FeV
Electro Metallurgical Co.	"
Erie Forge Co.	"
Erie Forge & Steel Co.	"
Fairbanks Morse Co.	"
Fairmont Chemical Co.	V Metal
Falk Corp.	FeV
Ferro Enamel Corp.	ArmM Van
Follansbee Steel Corp.	FeV
Foots Mineral Co.	V Pent
Ford Motor Co.	FeV
General Aircraft Equip. Co.	"

[fol. 127]

DomesticYEAR -- 1944Page 3CUSTOMERMATERIAL

General Chemical Co.	V Pent
	ArmM Van CP
General Color & Chem. Co.	ArmM Van
General Dyestuff Corp.	"
General Motors Corp.	FeV
Glasco Finishing Co.	V Pent CP
	ArmM Van CP
	ArmM Van
Goodall-Sanford, Inc.	"
B. F. Goodrich Co.	FeV
Gorham Tool Co.	"
Gould's Pumps, Inc.	"
Great Lakes Steel Corp.	V Pent CP
Gunsack Machined Prods. Co.	ArmM Van
Hampton Co.	FeV
Hansell Elecock Co.	"
Harbison Walker Refractories	V Pent CP
Charles Hardy, Inc.	V Metal
Harshaw Chemical Co.	V Pent CP
	ArmM Van CP
	ArmM Van CP
Marvel Research Corp.	V Pent
Joshua Handy Iron Works	FeV
Heppenstall Co.	ArmM Van
Hercules Powder Co.	V Pent CP
	FeV
	V Pent
Hinderliter Tool Co.	"
Hoffman-La Roche, Inc.	ArmM Van CP
O. Hommel Co.	V Pent
Johns Hopkins Univ.	Sol. M. Van
Hypex Co.	FeV
Infilco Co.	"
Ingersoll Steel & Disc Div.	V Pent CP
Inland Steel Co.	FeV
Interchemical Corp.	"
International Harvester Co.	V Metal
International Min. & Chem. Corp.	FeV
Jessop Steel Co.	"
Jones & Laughlin Steel Corp.	FeV
Frederick Kahl Iron Foundry	V Pent
Kimble Glass Co.	Sol O Van
	Arm M Van
Koppers Co.	V Pent CP
Lakeside Laboratories	FeV
Latrobe Elec. Steel Co.	V Metal
	FeV
Locomotive Fin. Material Co.	"
Lukens Steel Co.	"
Lynchburg Foundry Co.	"
Machined Steel Cstg. Co.	"
A. D. Mackay	V Metal
P. R. Mallory & Co.	V Pent
Marion Steam Shovel Co.	FeV
Mass. Inst. of Tech.	V Pent
	V Pent CP
Maytag Co.	"

[fol. 128]

DomesticYEAR -- 1944Page 4CUSTOMERMATERIAL

Mesta Machine Co.	FeV
Metal Hydrides Inc.	V Pent CP
Metal & Thermit Corp.	FeV
Midvale Co.	"
Mine & Smelter Sup. Co.	V Pent CP
Monroe Steel Castings Co.	FeV
Motor & Machinery Cstgs. Co.	"
Muskegon Piston Ring Co.	"
National Alloy Steel Div.	"
Nat. Aniline Div.	ArmM Van
National Forge & Ordnance Co.	FeV
Niagara Falls Sm. & Ref. Co.	V Metal
Nichol Straight Foy Corp.	FeV
Nobilium Products, Inc.	V Metal
Nordberg Mfg. Co.	FeV
Ohio Steel Fdry. Co.	"
Ortho Products Inc.	ArmM Van CP
Otis Elevator Co.	FeV
Pacific Mills	ArmM Van
Parker Pen Co.	ArmM Van CP
Pennsylvania Elec. Steel Crystal Co.	ArmM Van
Penn State College	FeV
Peru Foundry Co.	ArmM Van CP
Phillips Petroleum Co.	FeV
Pittsburgh Fdry. & Mach. Co.	ArmM Van CP
Pittsburgh Nolls Div.	FeV
Pittsburgh Steel Foundry Corp.	"
Rhytechnical Inst. of Brooklyn	V Pent CP
Primos Chemical Co.	Sod O Van
Publicker Com. Alcohol Co.	V Pent
Pullman Standard Car & Fdry. Co.	FeV
Pusey & Jones Corp.	"
Rare Chemicals Inc.	V Pent
Raytheon Mfg. Co.	V Metal
Reliance Steel Cast. Co.	FeV
Rensselaer Valve Co.	FeV
Republic Steel Corp.	"
Romer Drug Co.	ArmM Van CP
Ross Moshan Fdries.	FeV
Rotary Elec. Steel Co.	"
Roxboro Steel Co.	"
Rustless Iron & Steel Co.	"
Saginaw Mall. Iron Div.	"
E. H. Sargent Co.	V Pent
Sharon Steel Corp.	FeV
Sherwin-Williams Co.	ArmM Van
Simonds Saw & Steel Co.	FeV
Sirtex Printing Co.	V Metal
	ArmM Van

[fol. 129]

DomesticYEAR -- 1944Page 2CUSTOMERMATERIAL

A. O. Smith Corp.
Standard Elec. Steel Ctg. Co.
Standard Oil Develop. Co.

V Pent
FeV

ArmM Van CP
V Pent
V Pent CP
ArmM Van CP
Sod O. Van
FeV

Standard Oil Co. of La.

Standard Steel Works Div.
Standard Ultramarine Co.
Standard Varnish Works
Stauffer Chemical Co.

V Pent
V Pent CP
ArmM Van
V Pent
FeV

Sterling Steel Casting Co.
Stoody Co.

V Pent CP
V Pent
ArmM Van
FeV

Strook & Wittenberg
Tennessee Eastman Co.
Textile Chem. Co.
Timken Roller Bearing Co.
Titanium Alloy Mfg. Co.

V Pent
V Metal
FeV
FeV

Union Steel Ctg. Co.
United Brass & Alms. Co.
United Engineering & Foundry Co.
United Merchants & Mfgs. Corp.
U. S. Steel Corp.
Universal Cyclops Steel Corp.

ArmM Van
FeV

Univ. of California
Univ. of Illinois
Valley Steel Casting Co.
Vanadium-Alloys Steel Co.

V Pent
V Pent CP
V Pent
FeV

Vicar Laboratories

V Metal
V Pent
V Metal

Victoreen Inst. Co.

ArmM Van CP
V Pent CP
FeV

Vulcan Crs. Steel Co.
Waldrich Co.
Walker & Co.

ArmM Van
ArmM Van CP
V Pent CP
FeV

Wallenck Fdry. Co.
Wampburn Mfg. Co.
West Steel Ctg. Co.
Westinghouse Elec. & Mfg. Co.

FeV
"
"

White Laboratories
Wilkening Mfg. Co.
Will Corp.
Worth Steel Co.
Youngstown /dry & Mach. Co.

V Pent
V Metal
V Pent
FeV
V Pent CP
FeV
"

CanadianYEAR -- 1944Page 6CUSTOMERMATERIAL

Canadian Copper Refiners
 Canadian Laboratory Supplies
 Dominion Tar & Chem. Co.

Sod O Van
 V Pent
 AmmM Van
 V Pent
 FeV

1944 Domestic & Canadian Price Ranges

Fe VOH - \$2.70 to \$2.80 per lb. Ctd. Van.
 Fe V Cru - \$2.80 to \$2.90 per lb. Ctd. Van.
 Fe V Pri - \$2.90 to \$3.00 per lb. Ctd. Van.
 V Pent - \$1.10 per lb. V205 Ctd to \$1.25 per lb. Mat'l
 AmmM Van - \$1.90 to \$2.20 per pound
 V Metal 90% - \$3.30 to \$3.50 per lb Ctd V
 V Metal 95% - \$.40 to \$.45 per gram
 V Pent CP - \$7.00 per pound
 AmmM Van CP - \$7.00 per pound
 Sod O Van - \$.90 to \$2.20 per pound

Prices the same to all customers for similar quantities, sizes - on contract and spot bases. Special Grinding and Quality extras not indicated in above standard prices.

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IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 18

Compilation of United States Vanadium Corp. V₂O₅ Production, United with Plant

	1	2	3	4	5	6	7	8
	Rifle Prod. Lbs., V ₂ O ₅	Uravan Prod. Lbs. V ₂ O ₅	Tot. Rifle Uravan Durango, Prod. Prod. Lbs. Lbs. V ₂ O ₅	Durango USV-MNC V ₂ O ₅	Gateway Alloys Inc.-USV-MNC Lbs. V ₂ O ₅	Garfield Van. Corp. Prod. USV- MNC, Lbs. V ₂ O ₅	Plant-A Gr. Jst. USV Contract Acct. Lbs. V ₂ O ₅	Tot. USV Prod, Incl. All Agencies Lbs. V ₂ O ₅
1948	0	1,875,695	1,875,695		0			1,875,695
1949	0	1,995,717	1,995,717		1,000 (B)			1,995,717
1950	0	2,194,105	2,194,105		5,000 (B)			2,194,105
1951	0	2,377,700	2,376,700	0	5,000 (B)			2,376,700
1952 Rifle Plant Reopened	1,285,417	2,224,831	3,510,248	186,632	40,000 (J)		0	3,736,880
1953	1,567,685	1,734,229	3,301,914	852,884	80,000 (J)	0	185,620 (J)	4,420,418
1954 Uravan Plant Closed June	1,852,921	701,174	2,554,095	300,377	8,500 (J)	257,192	820,606 (J)	3,940,770
1955	1,729,260	83,901 (A)	1,813,161	365,616	0	0	916,095 (J)	3,094,872

rp. V205 Production, United States Total Production, United States Imports and Comparison of Same
with Electro-Met. Sales

7	8	9	10	11	12	13	14	15	16	17	18	19	20
Plant-A Gr. Jpt. USV Contract 5 Acct. Lbs. V205	Tot. USV Prod. Incl. Agencies Lbs. V205	VCA Monticello Prod. Lbs. V205	VCA-MEC Monticello Prod. Lbs. V205	Mammoth- St. Anthony Lead Vanadate Prod. Lbs. V205	Vitro Chem. Co. Prod. Lbs. V205	No. Cont. & Shattuck Chem. Prod. Lbs. V205	Blanding Prod. Lbs V205	Tot. U.S. Domestic Prod. Lbs. V205	%Tot. Rifle Uravan, Durango Prod. In Rel. to Tot. U.S. Dom. Prod.	%Tot. USV Prod. Inc. All Agencies in Rel. to Tot. U.S. Dom. Prod.	Tot. Imp. Lbs. V205	Tot. V205 Available in U.S. Imports & Domestic	%Tot. USV Prod. Inc. All Agencies in Rel. to Tot. U.S. Dom. Prod.
	1,875,695			166,600 (K)	140,365	-		2,100,000	85.70%				
	1,975,717			20,000 (Q)	161,410	-		2,178,127 (W)	91.62%			1,854,000 (H)	4,042,660
	2,194,165	0		128,000 (K)	172,750	-		2,499,915 (A)	87.77%			2,856,090 (H)	5,034,217
	2,376,700	400,000 (H)	0	141,600 (S)	175,000 (J)	-	0	3,098,300 (M)	76.71%			3,448,590 (H)	5,948,505
0	3,736,880	439,500 (J)	235,000 (J)	125,000 (J)	35,000 (J)	85,000 (J)	59,000 (J)	4,715,380	74.44%	79.25%		2,864,175 (H)	5,962,475
185,620 (J)	4,420,418	752,000 (J)	817,000 (J)	44,700 (J)	11,000 (J)	20,000 (J)	11,000 (J)	6,076,118	54.34%	72.75%		3,244,200 (J)	7,959,580
820,606 (J)	3,940,770	786,000 (J)	150,000 (J)	6,000 (J)	0 (J)	9,800 (J)	11,010 (J)	4,903,580	54.97%	80.36%		2,749,000 (H)	8,825,118
916,095 (J)	3,094,872	505,000 (J)	730,000 (J)	0	74,000 (J)	2,000 (J)	0	4,405,872	41.15%	70.24%		1,720,425 (H)	6,624,005
												2,078,925 (H)	6,484,797
1,922,321	32,113,864	2,882,500	1,932,000	838,405	991,289	161,000 +	81,010	39,011,068	72.51%	82.32%	30,078,185	69,069,253	46.48%

21	22	23	24	25	26	27	28	29
Electro-Met Domestic Sales Ferro-Vanadium Lbs. cont. V205	Electro-Met Canadian Sales Ferro- Van. Lbs. cont. V205	Total E-M Sales Ferro- Van. & Canadian Lbs. cont. V205	E-M Sales Ferro-Van. in Domestic Relation to Tot. Avail. V205 Inc. Imports	E-M Sales Fused Oxide in Lbs. cont V205	E-M Sales Red Cake in Lbs. cont. V205	Tot. E-M Sales Ferro-V. and Fused Oxide in Lbs. cont. V205	%E-M Sales in Rel. to Tot. Dom. Prod. of V205	%E-M Sales in Rel. to Tot. V205 U.S. Inc. Imports

1927	331,028 (P)	331,028	9.65%	22,300		353,328	28.41%	10.31%
1928	984,994 (P)	984,994	69.94%	55,134		1,040,128	84.22%	73.85%
1929	690,444 (P)	690,444	17.85%	21,001		711,445	59.08%	18.39%
1930	296,716 (P)	296,716	11.89%	87		296,803	27.47%	11.90%
1931	317,420 (P)	1,072	319,092	18.49%	3,969	323,061	18.72%	18.72% (V)
1932	131,536 (P)	9,090	140,626	19.42%	0	140,626	19.41%	19.41% (V)
1933	544,460 (P)	27,614	572,074	10.62%	217,334	789,408	14659.38%	14659.38% (V)
1934	430,300 (P)	25,200	455,500	79.75%	788,138	12,045	1,255,683	7485.44%
1935	430,638 (P)	18,900	449,538	231.72%	499,664	21,449	970,651	1427.43%
1936	460,836 (P)	20,338	481,174	74.50%	366,437	11,691	859,302	459.90%
1937	583,808 (P)	32,552	616,360	19.63%	551,565	37,105	1,205,030	82.84%
1938	251,150 (P)	11,830	262,980	6.51%	152,176	20,153		38.37%

1938		0	1,875,695	1,875,695	0		1,875,695		
1939		0	1,995,717	1,995,717	1,000	(b)	1,975,717		
1940		0	2,194,105	2,194,105	5,000	(B)	2,194,105	0	
1941		0	2,371,700	2,376,700	0	5,000 (B)	2,376,700	400,000 (H)	0
1942	Rifle Plant Reopened	1,285,417	2,224,831	3,510,748	186,632	40,000 (J)	0	3,736,880	439,500 (J) 235.
1943		1,567,685	1,734,229	3,301,914	852,884	80,000 (J) 0	185,620 (J)	4,420,418	752,000 (J) 817.
1944	Grayson Plant Closed June	1,852,921	701,174	2,554,095	300,377	8,500 (J) 257,192	820,606 (J)	3,940,770	786,000 (J) 150.
1945		1,729,260	83,901 (A)	1,813,161	365,616	0 0	916,095 (J)	3,094,872	505,000 (J) 730.
	TOTALS	13,648,774	14,451,568	28,100,342	1,705,509	139,500	257,192	1,922,321	32,113,864 2,882,500 1,937.

- (A) U. S. V. Durango Prod.
 (B) Estimated production - Plant Operated intermittently, during year (prior to Metals Reserve)
 (C) Shattuck Chemical Co. prod. only 85% recovery
 (D) Vitro Chemical Co. prod. calculated from 85% recovery of Utah production
 (E) Mammoth-St. Anthony Prod. calculated at 70% recovery.
 (G) Mammoth-St. Anthony, Mines closed May 15, 1937
 (H) V.C.A. Naturita Mill operated full year in 1941 Prod. estimated from known prod. in 1942
 (J) Known production
 (K) United States Vanadium Corp. practically sole producer in United States
 (L) All production in U. S. from Utah and Colorado sold through Howard Balseley
 (M) Includes Gateway private production
 (N) U.S.B.M. Import figures of V changed to V2O5
 (P) Includes 2 for 1 conversion factor to change V to V2O5 used and corrected to 75% recovery
 (R) Includes Export Sales in addition to Canadian
 (S) Includes "Conversion" oxide
 (T) Export Sales in addition to Domestic and Canadian
 (U) Ores and Metals inventory December 31, 1945
 (V) No imports into U. S. this year

1927	331,
1928	984,
1929	690,
1930	296,
1931	317,
1932	131,
1933	544,
1934	430,
1935	430,
1936	460,
1937	583,
1938	251,
1939	541,
1940	880,
1941	2,666,
1942	2,625,
1943	3,094,
1944	1,864,
1945	1,220,
TOTALS	18,347,

21
 Electr
 Domestic
 Ferro-
 L.S.co

1,875,695			166,600 (M)	140,362	-		2,100,000	85.70%		1,854,000 (M)	4,042,660	80.00%	
1,975,717			20,000 (Q)	161,410	-		2,178,127 (M)	91.62%		2,856,090 (M)	5,034,217	39.64%	
2,194,165	0		128,000 (E)	172,750	-		2,499,915 (A)	87.77%		3,448,590 (M)	5,948,505	30.89%	
2,376,700	400,000 (H)	0	141,600 (S)	175,000 (J)	-	0	3,098,300 (M)	76.71%		2,864,175 (M)	5,962,475	39.86%	
0	3,736,880	439,500 (J)	235,000 (J)	125,000 (J)	35,000 (J)	85,000 (J)	59,000 (J)	4,715,380	74.44%	79.25%	3,244,200 (..)	7,959,580	46.95%
185,620 (J)	4,420,418	752,000 (J)	817,000 (J)	44,700 (J)	11,000 (J)	20,000 (J)	11,000 (J)	6,076,118	54.34%	72.75%	2,749,000 (M)	8,825,118	50.09%
820,606 (J)	3,940,770	786,000 (J)	150,000 (J)	6,000 (J)	0 (J)	9,800 (J)	11,010 (J)	4,903,580	54.97%	80.36%	1,720,425 (M)	6,624,005	59.49%
916,095 (J)	3,094,872	505,000 (J)	730,000 (J)	0	74,000 (J)	2,000 (J)	0	4,405,872	41.15%	70.24%	2,078,925 (M)	6,484,797	47.72%

1,922,321	32,113,864	2,882,500	1,932,000	838,405	991,289	161,000 +	81,010	39,011,068	72.51%	82.32%	30,078,185	69,069,253	46.48%
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	21	22	23	24	25	26	27	28	29
	Electro-Met Domestic Sales Ferro-Vanadium Lbs. cont. V ₂ O ₅	Electro-Met Canadian Sales Ferro-Van. Lbs. cont. V ₂ O ₅	Total E-M Sales Ferro-Van. Domestic & Canadian Lbs. cont. V ₂ O ₅	E-M Sales Ferro-Van. in Relation to V ₂ O ₅ Inc. Imports	E-M Sales Fused Oxide in Lbs. cont. V ₂ O ₅	E-M Sales Red Cake in Lbs. cont. V ₂ O ₅	Tot. E-M Sales Ferro-V, Red Oxide in Lbs. cont. V ₂ O ₅	E-M Sales in Rel. to Tot. Dom. Prod. in Lbs. cont. V ₂ O ₅	E-M Total Sales in Rel. to V ₂ O ₅ U.S. Inc. Imports
1927	331,028 (P)		331,028	9.65%	22,300		353,328	28.41%	10.31%
1928	984,994 (P)		984,994	69.94%	55,134		1,040,128	84.22%	73.85%
1929	690,444 (P)		690,444	17.85%	21,001		711,445	59.08%	18.39%
1930	296,716 (P)		296,716	11.89%	87		296,803	27.47%	11.90%
1931	317,420 (P)	1,072	319,092	18.49%	3,969		323,061	18.72%	18.72% (V)
1932	131,536 (P)	9,090	140,626	19.42%	0		140,626	19.41%	19.41% (V)
1933	544,460 (P)	27,614	572,074	10,623.47%	217,334		789,408	14659.38%	14659.38% (V)
1934	430,300 (P)	25,200	455,500	79.75%	788,138	12,045	1,255,683	7485.44%	219.84%
1935	430,638 (P)	18,900	449,538	231.72%	499,664	21,449	970,651	1427.43%	500.34%
1936	460,836 (P)	20,338	481,174	74.50%	366,431	11,691	859,302	459.90%	133.05%
1937	583,808 (P)	32,552	616,360	19.63%	551,565	37,105	1,205,030	82.84%	38.37%
1938	251,150 (P)	11,830	262,980	6.51%	152,376	20,357	435,713	19.91%	10.78%
1939	541,088 (P)	15,934	557,002	11.06%	615,890 (8)	76,624	1,249,516 (M)	57.37%	24.82%
1940	880,988 (P)	155,484 (M)	1,036,472	17.42%	213,470 (8)	135,786	1,914,852 (8)	76.60%	32.19%
1941	2,666,806 (P)	242,626	2,909,432	48.79%	187,843	48,074	3,145,349	101.52%	52.75%
1942	2,625,024 (P)	181,918	2,806,942	35.26%	277,088	32,675	3,116,705	66.10%	39.16%
1943	3,094,880 (P)	262,780	3,357,660	38.05%	195,413	7,898	3,561,171	58.61%	40.35%
1944	1,864,970 (..)	101,876	1,966,846	29.69%	118,589	29,738	2,115,173	43.14%	31.93%
1945	1,220,590 (P)	132,128	1,352,718	20.86%	84,871	37,309	1,474,898	33.47%	22.74%
TOTALS	18,347,676	1,240,122 (P)	19,587,798 (P)	28.55%	4,900,292	470,751	24,958,841	63.98%	30.12%
							1,040,655 (U)		

[fol 132]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 19

IN UNITED STATES DISTRICT COURT

*Plaintiffs' Exhibit No. 19***EXHIBIT A**

SCHEDULE SHOWING NUMBER OF TOTAL REQUIREMENTS CONTRACTS FOR FERROVANADIUM AND VOLUME IN POUNDS OF CONTAINED VANADIUM SOLD AGAINST SUCH CONTRACTS FOR EACH YEAR FROM 1933 THROUGH 1949

Year	No. of Total Requirement Contracts For Ferrovandium	Volume in Pounds of Ctd. V Sold Against Total Requirement Contracts For Ferrovandium
1933	61	103,174.09
1934	67	154,398.80
1935	67	177,721.29
1936	96	336,798.16
1937	104	636,948.69
1938	126	190,797.79
1939	126	455,171.33
1940	143	791,287.44
1941	152	1,418,845.22
1942	103	2,233,613.18
1943	102	1,099,552.38
1944	99	910,074.60
1945	123	1,152,268.07
1946	119	537,264.75
1947	108	508,317.02
1948	110	660,298.20
1949	126	371,515.01

[fol. 133]

UNION CARBIDE

INTERROGATORY NO. 28

The number of total requirement contracts under which sales of ferrovanadium or vanadium oxide were made for each of the years indicated below, together with the quantity sold thereunder, is as follows:

<u>Year</u>	<u>No. of Contracts</u>	<u>Pounds Contained Vanadium Delivered</u>
1937	23	130,044
1938	36	55,118
1939	33	64,136
1940	48	150,509
1941	59	210,404
1942	36	522,169
1943	27	277,000
1944	40	203,450
1945	40	160,475
1946	28	153,573
1947	34	117,645
1948	29	121,009
1949 (7 mos.)	22	40,653

<u>Year</u>	<u>No. of Contracts</u>	<u>Pounds Contained V2O5 Delivered</u>
1937	3	37,556
1938	3	13,859
1939	3	73,524
1940	4	119,300
1941	4	71,102
1942	3	63,951
1943	3	40,104
1944	2	40,747
1945	1	67,414
1946	4	21,556
1947	2	30,073
1948	2	61,725
1949 (7 mos.)	0	None

[fol. 134]

VANADIUM CONTRACTS OF AMERICA

**PERCENTAGE OF INCLUSIVE FINEO VANADIUM AND VANADIUM PENTOXIDE
 CONTRACTS TO TOTAL FINEO VANADIUM AND VANADIUM PENTOXIDE CONTRACTS
YEAR 1960**

	<u>Fineo Vanadium</u>	<u>Vanadium Pentoxide</u>
No. exclusive contracts to Total contracts	91.88%	89.71%
Quantity sold on exclusive contracts to total quantity sold	97.96%	95.08%

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[fol. 135]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 21

IN UNITED STATES DISTRICT COURT

*Plaintiff's Exhibit No. 21*INTERROGATORY NO. 8 (a)

VANADIUM BEARING ORES MINED BY UNITED STATES
 VANADIUM CORPORATION FROM COMPANY OWNED AND
 LEASED CLAIMS 1933 to DEC. 31, 1947

	<u>Tons</u>
1933	None
1934	"
1935	"
1936	10,809.564
1937	55,729.291
1938	71,085.451
1939	82,855.230
1940	77,231.500
1941	87,203.053
1942	119,109.558
1943	120,857.344
1944	65,803.570
1945	87,218.122
1946	43,334.687
1947	87,261.405

125

[fol. 136]

INTERROGATORY NO. 8 (b)

VANADIUM-BEARING ORES PURCHASED BY
UNITED STATES VANADIUM CORPORATION
FROM INDEPENDENT PRODUCERS 1933
to DECEMBER 31, 1947

	Tons
1933	None
1934	"
1935	"
1936	"
1937	"
1938	476.200
1939	1,568.725
1940	21,265.847
1941	30,111.058
1942	6,896.633
1943	2,292.923
1944	7,104.924
1945	8,125.972
1946	719.380
1947	None

VANADIUM-BEARING ORES PURCHASED BY
UNITED STATES VANADIUM CORPORATION,
AS AGENT FOR METALS RESERVE COMPANY

	Tons
1942	17,819.009
1943	145,196.098
1944	15,202.373

[fol. 137]

[Handwritten notation—VCA]

EXHIBIT I
**QUANTITATIVE YEARLY TOTALS OF VANADIUM-
BEARING ORES MINED - 1933 - 1947**

Year	Net Dry Tons
1933	None
1934	None
1935	1,382
1936	4,926
1937	12,498
1938	21,740
1939	34,243
1940	46,592
1941	63,615
1942	80,612
1943	94,210
1944	52,948
1945	63,949
1946	37,827
1947	63,336
TOTAL	577,878

NOTE: Includes 30,342 tons of ore sold to Metals Reserve Company during the years 1941 through 1944, which were repurchased by Vanadium Corporation of America in 1945 and reported as "purchased" in Exhibit II.

[fol. 138]

EXHIBIT IIQUANTITATIVE YEARLY TOTALS OF VANADIUM-BEARING
ORES PURCHASED - 1933 - 1947

<u>Year</u>	<u>Net Dry Tons</u>
1933	None
1934	None
1935	None
1936	None
1937	None
1938	None
1939	None
1940	4,380
1941	10,280
1942	17,079
1943	6,946
1944	6,711
1945 -	- 37,265
1946	2,291
1947	<u>7,750</u>
TOTAL	<u>92,702</u>

NOTE: Includes 30,342 tons in 1945 purchased from Metals Reserve Company, which had been mined and sold by Vanadium Corporation of America during years 1941 through 1944 to Metals Reserve Company and reported as "mined" ore in Exhibit I.

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 24

IN UNITED STATES DISTRICT COURT

*Plaintiff's Exhibit No. 24*INTERROGATORY 8(h)

Total quantity of vanadium-bearing ores, vanadium oxide
and ferrovanadium purchased from Metals Reserve Company.

UNION CARBIDE AND CARBON CORPORATION
ORE AND METAL DIVISION

PURCHASES OF VANADIUM OXIDE (V₂O₅)

1943	859,832.76 lbs.
1944	59,520.75 lbs.

★ 919,403.51

UNITED STATES VANADIUM CORPORATIONPURCHASES OF VANADIUM-BEARING ORE

1945	3,523.186 dry tons.
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EXHIBIT VII

QUANTITY OF VANADIUM-BEARING ORES
PURCHASED FROM METALS RESERVE COMPANY

<u>Year</u>	<u>Dry Tons</u>
1945	30,342

QUANTITIES OF VANADIUM OXIDE PURCHASED
FROM METALS RESERVE COMPANY

<u>Year</u>	<u>Lbs. V₂O₅</u>
1942	127,332.07
1943	854,107.15
1944	774,145.63
1945	101,383.61

QUANTITY OF FERROVANADIUM
PURCHASED FROM METALS RESERVE COMPANY

<u>Year</u>	<u>Lbs. V</u>
1945	101,383.61

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[fol. 141]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 33

United States Vanadium Corp.

New York City

September 14, 1938

Outside Vanadium Ore Production

Mr. Blair Burwell
United States Vanadium Corp.
Uravan, Colorado

Dear Blair:

As I discussed with you the other night on the telephone, it has become very important that we find out accurately and definitely who is producing vanadium ore and where it is going. Along with this, we want to know the quality of the ore shipped so that we can get a line on the pounds of V_2O_5 . I realize that some of the quality will have to be estimated, but we ought to get a very accurate line on what the shipments have been from southeastern Utah and southwestern Colorado. We may have to do something about this production, and if information could be obtained on what they get for this ore, it would help out. For instance—Harbison told me that he received 42¢ per pound for V_2O_5 and 60¢ per pound for U_3O_8 on a low-grade Polar Mesa ore, but if the V_2O_5 went over 7%, and the U_3O_8 over 2%, he received 45¢ per pound of V_2O_5 and 80¢ per pound for U_3O_8 . These are pretty high prices for us, but it may be necessary to finally do something about it.

I have an idea that this production of ore which is going to Europe and Japan is quite a quantity of V_2O_5 , and more than we think it is. I have been talking about this for some time here in New York, stating that the high prices maintained for V_2O_5 in Europe invite and stimulate this kind of competition and can eventually support a considerable vanadium business, with possibly later on a plant.

In this respect I have had some correspondence with King about the application made by Balsley and Kipe for a freight rate on vanadium ore to Castleton, N. Y. where it is claimed the ore will be reduced. We cannot get any line on this plan here, and at Castleton there is no plant now available for this kind of work.

I hope you will be able to put somebody on this and make a very careful canvass of the situation. If you could have a talk personally with Balsley you could probably find out all about it. In talking to Balsley it would be to his advantage to give you this information because I have an idea that he is not making any too much money out of this business, and it might be made easier for him on some kind of a combination with us if we decide to do something about it, rather than to fight it. We could, of course, run all this business out—but it would not be good policy to hint of this or threaten.

In this connection, I would like to have a line on the Shattuck Chemical Company production. They are selling fused oxide not only in this country, but in Europe. Their oxide is low-grade containing only a little over 50% V_2O_5 , [fol. 142] but they are selling it for less money. I have an idea their production is about 25 tons of fused oxide a year, but you may be able to get a closer line on this. From the record, you will be able to gather on the shipments to Vitro, we can get a line on their production of V_2O_5 .

I have a pretty good line on the production of vanadium in Mammoth, Arizona, as it is all sold through a friend of mine here in New York.

Will you please see what you can do about this for me.

Very truly yours,

J. R. Van Fleet/mm
IC

[fol. 143]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 34

[Handwritten notations—Vanadium Situations—Extra]

General Mining Department

New York City

September 19, 1938

Mr. F. P. Gormely
Room 1813
Building

Mr. J. D. Swain
Mr. W. H. Sneath

Competitive Vanadium Ore
Production

Dear Mr. Gormely:

A preliminary investigation of the vanadium ore production in southeastern Utah and southwestern Colorado has been made. The investigation is being continued and will be made complete at a later date. Preliminary figures indicate that the V_2O_5 content of the ore which has been shipped already this year up to September 1st amounts to approximately 225,100 lbs. It is thought that for the balance of this year production will be at about the same rate, and the total ore production will amount to approximately 338,000 pounds contained V_2O_5 .

The preliminary report does not give exports to Europe, but 7 cars containing 34,000 lbs. V_2O_5 have been shipped to Japan already this year. An approximate list of these shipments to September 1, 1938 follows:

Japan	7 cars	34,000 lbs. V_2O_5
Vitro Mfg. Co.	29 "	125,500 " "
Shattuck Chemical Co.	2 "	5,600 " "
North Continent Mining Co. (Produced)		40,000 " "
Misceellaneous		20,000 " "
		<hr/> 225,100 " "

The 7 cars of ore which were sent to Japan were produced from the Temple Mountain, Yellow Cat and Polar Mesa properties in southeastern Utah. A Japanese outfit started to build a mill at Temple Mountain to concentrate ore from the many dumps. They worked about 60 days, apparently ran out of money and left the property—leaving unpaid bills. The ore shipped from Yellow Cat and Polar Mesa was purchased from the operators of those properties.

The Vitro Manufacturing Company has purchased 29 cars containing 125,500 lbs. V_2O_5 . This ore also contains better than 2% U_3O_8 . The Vitro Manufacturing Company process this ore from the uranium and sell the vanadium residue in some convenient form, recently reported as being fused oxide. It is not known at present where this vanadium goes. About half of these 29 cars have been produced at Polar Mesa by Harbison and Kipe. They receive high prices for this ore, viz., 45¢ per pound of V_2O_5 and 80¢ per pound of U_3O_8 contained in the ore. Vitro pays the freight from Utah.

[fol. 144] *The Shattuck Chemical Company* of Denver has purchased 2 cars of rather low-grade ore containing 5,600 lbs. of V_2O_5 . These 2 cars were specially selected uranium ore and contained higher uranium in proportion to V_2O_5 than most shipments.

The North Continent Mining Company has a small plant in the Paradox Valley and has produced about 40,000 lbs. of V_2O_5 so far this year. This production is sent to the Shattuck Chemical Company in Denver. This production of the North Continent Mining Company purchased by Shattuck rather checks previous information that Shattuck Chemical Company produces and markets between 50,000 and 75,000 lbs. of V_2O_5 yearly. They put this in the form of fused vanadium oxide with varying degrees of purity and containing from 51 to 75% V_2O_5 .

There has been an estimated miscellaneous production of approximately 20,000 lbs. V_2O_5 from various sources.

If the production for the rest of 1938 is in proportion, the entire 1938 production will amount to approximately 338,000 lbs. contained V_2O_5 from these ore sources.

The Mammoth Mine in Arizona has an appreciable production of vanadium. Several years ago the Molybdenum Corporation of America built a mill at Mammoth with which to process ores extracted from the New Year and Mohawk properties. They entered into a contract with the owners of the Mammoth mine adjoining, to also treat ores from that mine. The treatment and recoveries were not satisfactory to Mammoth. Consequently, about January 1, 1938 Mammoth purchased the mill from the Molybdenum Corporation and took over the milling operation. Concentrates are made in this mill containing gold, lead, molybdenum and vanadium. The concentrates contain about 5% V_2O_5 and 7% MoO_3 .

We have looked over this operation, obtained samples of concentrates and are able to check up fairly well the production. The present capacity of the Mammoth mill would yield approximately 100,000 lbs. V_2O_5 yearly, which checks closely with the 1937 production amounting to 90,000 lbs. V_2O_5 purchased by Associated Metals and Minerals Company.

The Mammoth mine is owned by Lloyd-Smith, owner of Time, Life and Fortune magazines, and it is incorporated under the name of Mammoth Saint Anthony Company. Foster Naething is the General Manager of this company and is a very competent mining engineer.

If we add this 100,000 lbs. V_2O_5 to the competitive ore production listed above, the total competitive production for 1938 will be approximately 438,000 lbs. V_2O_5 . There are many attractive occurrences of carnotite ore in the Southwest, and the production could easily be twice as much—given adequate financing and management.

[fol. 145] One potential producer of V_2O_5 is the *Anaconda Copper Company*. In Idaho they produce phosphate rock, moving it to Anaconda, Montana for processing into fertilizer and phosphoric acid. The plant for this purpose at Anaconda is in connection with the smelter where they obtain cheap acid. This phosphate rock all contains a small amount of vanadium, and a process has been developed for recovering the vanadium from the phosphoric acid solution.

They expected to be producing vanadium this year, after installing equipment costing about \$200,000, but they did not feel inclined to proceed with this expenditure this year. I imagine when business is better they will begin producing fused oxide. It is estimated that this plant will produce approximately 100,000 lbs. V_2O_5 yearly, and we have agreed to purchase the output.

The International Vanadium Corporation has taken over the lead vanadate property at Dripping Springs, Arizona. It is now being managed by one de Villiers, who was for a time employed at Rhodesian Broken Hills. The company is now well financed and the plan is to produce lead vanadate concentrates containing 17% V_2O_5 . de Villiers claims that he can do this for 19c per pound of V_2O_5 , producing 4 tons of concentrates per day. This production, if carried through, would amount to approximately 40,000 lbs. V_2O_5 monthly, or 480,000 lbs. yearly. They expect to be in production in about 3 months.

I have recently made two visits to Dripping Springs and one of our field engineers has sampled the Dripping Springs mine. We have paid particular attention to this operation from its inception several years ago. We could never check the quality or quantity of ore claimed. The last sampling, which was very comprehensive, confirmed our previous impression, and we cannot see how a profitable operation can be maintained at this place. The ore is entirely too low-grade—containing approximately 20% V_2O_5 , with a small tonnage. There will be however, some concentrates made at this place, as in the past, but we anticipate that after a few months this operation will have to close.

For the last two years we have been making a comprehensive investigation of all vanadium resources in the Southwest, which we expect to finish this season. Several attempts have been made to erect small roasters, mills and other equipment for processing these ores on a small scale. So far all of these attempts have met with failure. There is a new one going in now at *Gateway* and is being managed by Harry Brown, who up until about 9 months ago was employed by us at Uravan as a draftsman. It is reported that Harry Brown is being backed by his father and has

raised \$20,000 with which to install a 20 ton plant which will be designed to produce fused oxide. He intends to make the roaster from original designs, and it is evident additional funds will be necessary. The ore will be obtained from Polar Mesa and from the deposits on the other side of the Dolores River in the vicinity of Gateway. There are a number of small, high-grade deposits in this locality.

[fol. 146] Probably the best of the outside resources are in southeastern Utah around Blanding and in Dry Valley. Last year, as a result of our investigations, we considered that we should purchase additional property in that locality, and \$200,000 was put into the original 1938 Budget to cover these purchases. Due to poor business conditions however, it was not thought desirable to pursue recommendations for this purpose. We will renew this request in the 1939 Budget.

We have already purchased two or three groups of claims which were potential producers and could be the nucleus of an operation. The intensive development during the past year has made it more imperative to continue this policy, and it now appears that we should purchase some properties and possibly install a small plant in southeastern Utah to forestall serious competition. A definite recommendation will be made on this as soon as the field work has been finished.

Very truly yours,

J. R. Van Fleet/mm
IC

[fol. 147]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 36

[Handwritten notations—V/P—Custom Ore]

United States Vanadium Corp.

New York, N. Y.

December 24, 1941

Mr. J. E. Weston
 United States Vanadium Corporation
 Uravan, Colorado

Mr. Blair Burwell
 Mr. A. H. Coleman

AIR MAIL

Dear Joe:

Yesterday Mr. Kett of the Vanadium Corporation of America called up to protest against some attempt on our part to take a customer away.

The story is that you went to one Lyen, operating in the Cedar district, offering him \$2.00 per ton above the established rate, which he in turn reported to the Vanadium Corporation of America. Knowing nothing of the circumstances surrounding the case, or of Lyen either, I advised Mr. Kett that I would look into the matter.

Will you kindly give me the details of this case.

With kind regards, and with best wishes to yourself and Mrs. Weston for a Happy and Prosperous New Year, I am

Yours very truly,

AF/W. G. Haldane
 IC

[fol. 148]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 37

[Western Union Form]

[Handwritten notations—Mrs. Teddy—1944—EMT—Also
Durango Plant Purchase—Also N. Continental-Winters.]

WUG208 38=GRAND JUNCTION COLO FEB 29 1111A
W G HALDANE=

BROCK ADVISES THAT BRINKER WITH SITTON
AND OTHER PROMOTERS ARE REPORTED TO BE
PLANNING TO TAKE THE DURANGO PLANT IN
CASE WE DO NOT RECAPTURE IT STOP THIS IS
RUMOR ONLY BUT SUGGEST YOU ADVISE MR
RAFFERTY REGARDS=

BLAIR BURWELL.148P

[fol. 149]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 40

[Letterhead of Continental Ore Company,
New York 18, N. Y.]

November 16, 1943

The Vanadium Corporation of America
Graybar Building
420 Lexington Avenue
New York, N. Y.

Attention: Mr. G. Laub

Gentlemen:

Re: Vanadium Pentoxide

We would appreciate your offering us:

10,000 to 15,000 lbs. of V_2O_5 contained in vanadic acid,
per month.We would be ready to sign a contract with you for a fixed
length of time.

Very truly yours,

CONTINENTAL ORE COMPANY

/s/ HENRY J. LEIR
Henry J. Leir

hjl/hc

[Stamp—Received—Nov 17 1943—G. L.]

[fol. 150]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 41

[Letterhead of Vanadium Corporation of America,
New York 17, New York]

November 19, 1943

Continental Ore Company
500 Fifth Avenue
New York 18, New York

Attention: Mr. Henry J. Leir

Gentlemen:

RE: VANADIUM PENTOXIDE

In response to your inquiry of November 16th requesting quotation on 10,000 to 15,000 pounds monthly of V_2O_5 contained in Vanadic Acid, we regret very much that due to our present commitments we are not in position to take on this additional tonnage at the present time.

Perhaps if you are still interested at a later date and our situation changes, we will be glad to look into the matter further at that time.

Regretting our inability to be of service to you at this time, we are

Very truly yours,

/s/ GUSTAV LAUB
Assistant Vice President

GL:HK

[fol. 151]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 42

November 30, 1943

Electro Metallurgical Sales Corp.
30 East 42nd Street
New York, N. Y.

Attention: Mr. T. F. O'Heir

Gentlemen:

Re: Vanadium Pentoxide

We have not as yet received a reply from you to our letter of November 17, of which we enclose a copy since the original may have gone astray.

We would very much appreciate hearing from you regarding this matter at your earliest convenience.

Very truly yours,

CONTINENTAL ORE COMPANY

Henry J. Leir

hjl/hc
Enc.

156

[fol. 152]

C O P Y

November 17, 1943

Electro Metallurgical Sales Corp.
30 East 42nd Street
New York, N. Y.

Attention: Mr. T. F. O'Heir

Gentlemen:

Re: Vanadium Pentoxide

We would appreciate your offering us:

10,000 to 15,000 lbs. of V₂O₅ contained in fused vanadic
acid, per month.

We would be ready to sign a contract with you for a fixed
length of time.

Very truly yours,

CONTINENTAL ORE COMPANY

Henry J. Leir

hjl/sk

[fol. 153]

[Letterhead of Electro Metallurgical Sales Corporation,
New York 17, N. Y.]

November 30, 1943

Continental Ore Company
500 Fifth Avenue
New York 18, New York

Attention: Mr. Henry J. Leir

Gentlemen:

Referring to your inquiry for fused vanadium oxide, in view of the many uncertainties prevailing at the present time we do not feel that we should undertake supplying your regular requirements for this material.

Very truly yours,

ELECTRO METALLURGICAL SALES CORPORATION

By: /s/ W. E. REMMERS

W.E.Remmers:JC

[fol. 154]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 43

[Handwritten notation—Illegible]

The Secretary submitted Appropriation Request No. SMP-3, dated July 6, 1939, in the amount of \$7,000. to cover the estimated cost of Air Separator Table Installation at the Piney River plant of the Southern Mineral Products Corporation. After discussion, on motion regularly moved, seconded and carried, it was unanimously

RESOLVED, that Request for Appropriation No. SMP-3, in the amount of \$7,000. covering the estimated cost of Air Separator Table Installation at the Piney River, Va. plant of the Southern Mineral Products Corporation, be and is hereby approved, as recommended by the President.

The President advised that certain claims of the Vanadium Corporation of America located in Colorado were adjacent to claims of the United States Vanadium Corporation and that in view of the present mining operations of the United States Vanadium Corporation, said corporation is willing to mine and mill the ore on one particular claim, namely, the "Maggie C", or any other claim or claims that might later be agreed upon, delivering the product therefrom (oxide containing a minimum V_2O_5 content of 85%) to our Bridgeville, Pa. plant at a delivered price to be accepted if satisfactory to the Vanadium Corporation of America. He requested authority to enter into an agreement that would provide for the delivery of such ore at an agreed upon price. After a general discussion, on motion regularly moved, seconded and unanimously carried, the President was authorized to enter into an agreement, as outlined above, with the United States Vanadium Corporation.

After a general discussion of the affairs of the Corporation and business conditions, on motion regularly moved, seconded and carried, the meeting thereupon adjourned.

[Signature illegible]

Secretary

[fol. 155]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 57

VANADIUM BEARING
RAW MATERIAL

Following are the figures covering exports of contained vanadium in ore for the years 1935-1939 inclusive.

PERUVIAN ORE

Year		High Grade Mix	Low Grade Ore	Total
1935	Lbs. "V"	163,551		163,551
1936	"	424,947		424,947
1937	"	590,823	635,667	1,226,490
1938	"	926,930	838,096	1,765,026
1939	"	963,547	1,309,504	2,273,051
Totals		3,069,798	2,783,267	5,853,065

The low grade ore is shipped as taken from the ground. The shipments in 1937 consisted of mined Veta Madre ore and averaged approximately 6.5% vanadium and the cost delivered at Bridgeville was \$.39 per lb. contained vanadium.

Shipments made in 1938 and 1939 consisted of Oxide ore from the dumps at Mina Ragra and averaged around 5% in vanadium and the cost delivered at Bridgeville was \$.445 per lb. contained vanadium in ore.

The high grade mix consists of a mixture of precipitates and tailings or low grade oxide ore or of all three. In 1935 and 1936 all shipping mixture consisted of a mix of precipitates and tailings. In 1937 and 1938 the mixture was precipitates, tailings and oxide ore. In 1939 the mixture was precipitates and low grade oxide ore. The preparation of each in the mix is one part of precipitates to two parts of either tailings or low grade ore by weight. As an example—

1 part precipitates	37%	37
2 parts ore or tailings	3%	6
		<hr/>
3 parts		43
Average of mix		14.3%

Over the five-year period the cost of delivering this material to Bridgeville was \$.59 per lb. vanadium contained. In the years 1936 to 1937 inclusive, when practically all the material used for mixing was tailings, the average cost was approximately \$.58 per lb. vanadium contained in mix, delivered Bridgeville. In 1938 the mixture contained both tailings and oxide ore, low grade, and was delivered to Bridgeville at a cost of approximately \$.615 per lb. contained vanadium in mixture. In 1939 the mix consisted of precipitates and oxide ore, low grade only, and the delivered price was the same as in 1938, i.e. \$.615 per lb. contained vanadium in mix. Inasmuch as the oxide ore was taken from stock piles and not mined, when it is found necessary to mine oxide ore from the mine the cost will increase approximately \$.05 to \$.06 per lb. of contained vanadium delivered Bridgeville.

[fol. 156] PURCHASED V_2O_5

During the period from 1932 to 1939 the following purchases of pentoxide were made:

1932	3,956 lbs. V_2O_5	
1933	216,412 "	"
1934	483,202 "	"
1935	495,428 "	"
1936	360,401 "	"
1937	540,785 "	"
1938	147,552 "	"
1939	577,849 "	"
	<hr/>	
	2,825,585 "	"

The above purchased material was consumed as follows:

	<u>1932-1934</u>	<u>1935</u>	<u>1936</u>	<u>1937</u>	<u>1938</u>	<u>1939</u>
Ferro-vanadium	398,366	472,395	410,288	540,784	70,319	560,527
<i>Pentoxide</i>						
Air Dried		35,084				
Grainal						7,793
Sales-Domestic		59,401	600			
Sales-Export		96,121	86,350			45,294
Miscellaneous		127	669		2,164	141
Totals	<u>398,366</u>	<u>663,128</u>	<u>497,907</u>	<u>540,784</u>	<u>72,483</u>	<u>613,755</u>
						2,786,423
				Inv. 12/31/40		39,162
						<u>2,825,585</u>

Purchases from 1932 to 1936 were made to meet our demands for product which could not be filled from our Peruvian mine due to proving out a leaching process on our pilot plant there and the necessary time required to transfer the results from the 15-ton pilot plant to the 50-ton commercial plant and bring the 50-ton plant to commercial operating basis.

In 1937 and 1939 purchases were made to meet our commitments which were beyond our operating capacity at Bridgeville.

From 1932 to 1938 inclusive, purchases were on a straight purchase order basis at a price of \$.80 per lb. V_2O_5 contained, delivered Bridgeville. From June 30, 1939, deliveries were made under agreement for a delivery of ore by Vanadium Corporation of America to United States Vanadium as per contract, and an additional processing charge of \$.65 per lb. V_2O_5 contained, delivered Bridgeville. This price was increased to \$.75 for 1940 deliveries.

P.J.G.

4/4/40

[fol. 157]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 59-A

—2—

The Colorado Plateau was the only area in the United States actually producing uranium. Production came from low-grade carnotite ore mined primarily for vanadium, with uranium recovered as by-product. During the war the Manhattan District financed the construction and operation of two plants for the extraction of uranium from tailings of Colorado vanadium plants and also purchased uranium concentrates produced as a by-product from the vanadium operations. Following the war it was tentatively decided by the Manhattan District to purchase only by-product uranium rather than to stimulate and support increased production by special incentives. "This position was based on the fact that the known uranium reserves of the Colorado Plateau were limited and expensive to mine and process and that the only advantage of an accelerated program would be to make this limited supply available sooner. Since the estimated annual production of the Colorado Plateau, even under an accelerated program, would be small in relation to total U. S. requirements and to supplies available from foreign sources, it appeared more economical to obtain the uranium as a by-product from vanadium operations which were geared to the vanadium market. The quantity of vanadium produced is much greater than the quantity of uranium recovered from these operations.

(more)

[Handwritten notation—A marginal brace taking in lines 9 to 22 of the first paragraph and the initials BB have been drawn on this exhibit]

[fol. 158]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 62

SPECIAL REPORT
GUSTAV LAUB

February 20, 1942

APEX SMELTING COMPANY
Chicago, Illinois

Mr. Edward S. Christiansen—Vice Pres.

Mr. Christiansen, Vice President of the above company, whom I have known slightly for sometime, called on me stating that they have decided to go out of the Vanadium business and that they had certain equipment and some small stock of Oxide on hand that they would like to dispose of if we were interested.

He did not have an actual list of the equipment nor of the raw materials they have on hand but from the figures he had it looked as though they have close to 50,000 pounds of Vanadium Pentoxide containing between 78/87% V2O5 and about 40,000 to 50,000 pounds of Magnesite.

I told him that we might be interested in the Vanadium Oxide and possibly the Magnesite and some of the equipment which included jaw crushers and miscellaneous equipment. He promised to obtain from their Chicago office an actual complete list of the equipment they have to offer as well as the quantities and grades of Vanadium Oxide and Magnesite and to deliver these to me the early part of next week. I told him that I would then refer this to the proper parties of our company and that we would probably be interested in the Vanadium Oxide and the Magnesite if their prices were right. He stated that they would be reasonable in their prices and did not expect to make a profit.

Mr. Christiansen further stated that they had been contemplating going out of the Vanadium business for sometime and their definite decision was reached for two rea-

sons. First, that they had a fire in this department of their plant and secondly, that the sales contract which they had with Mr. Leir, President of the Continental Ore Corporation had not worked out very well. Mr. Leir was getting a fifty percent cut on the profits. Mr. Christiansen also stated that they had some agreements with the Shattuck Chemical Company and Niley & Smith for deliveries of Vanadium Oxide and that he would also look into this and advise us of the status thereof.

GL:ESW

[fol. 159]

VANADIUM CORPORATION OF AMERICA

INTER-OFFICE COMMUNICATION

Boulder, Colorado

DATE April 22, 1942.

FROM Robert Sterling, Manager

TO Mr. Frederick F. Kett,
Gen'l Manager Mining Division, N. Y.

SUBJECT Your Letter of April 20th.

Kimmerle Report — — As long as this matter has come up in the way it has, I think Kimmerly should be put on the spot to prove his statements. Such things do go on, whether at our plants or not, and it generally involves collusion between someone in the plant and some outsider. It would really go hard with them, if anything could be proved. However, all that can be left until you come out.

Sale of Ore to Balsley — There was some doubt in my mind about selling small lots to Balsley except on a cash-on-the-barrel-head basis. Even then, no matter what he promised, I think there would be interminable delay in getting the cash—as, always, in the past. I assume that if any high grade comes into Monti-

cello, it should be held and eventually transferred to Naturita for shipment from there with any carload of slimes that may be accumulated? In fact any high grade produced at the Yellow Bird may as well go direct to Naturita, and so save transferring it later on? They might run into another "Tree" at any time.

Dry Valley Claims — — — I have no doubt that the matter of the whereabouts of all the claims in Dry Valley will be cleared up in the course of time, and that there is really nothing to worry about, except to see that the Affidavits of Annual Assessment Work are filed. That is, of course, up to the Moly Corporation, or U.S.V. and can, as you say, be checked up at the Monticello (not Moab) court house. The claims are all in San Juan County.

Ore Prices — — — — Your decision on that matter is definite, so no price changes will be conceded without first getting authority from you. It's rather hard to know how to decide, when the producers tell us these stories about U.S.V. offering more, and then U. S. V. denying it. It is difficult to learn who is lying. Personally, I am inclined to believe the "honest miner."

Property Deals — — — It is my intention, of course, to advise and consult with you on any property deals. It seems to me the present arrangement should save you a lot of grief and letter writing, as I imagine you have plenty to do without being bothered with something that can be handled perfectly well out here without troubling you.

[fol. 160] That \$100.00 was paid on an option on the so-called Hyde claims belonging to Mrs. Hyde and two of her nephews, and which we have been trying to line up ever since last fall. These claims join the Happy Jack, the workings of which are getting pretty close to them. The \$100.00 was for 90 day option then \$1,000 down, then \$500.00 in 90 days, and the balance on a 10% royalty—total price \$6,000.00, I have asked Garard for copies of the option.

I have just received from Blitz, copies of the contract he has negotiated with the Waggoners on 15 claims on Carpenter mesa. You have a copy of his letter of April 20th, on the subject. In case he did not send you a copy of the contract, one is enclosed herewith. I shall sign and return them today.

Blitz is very sure there is \$3,000.00 worth of positive ore and that we are more than safe in buying them on the terms set out in the contract.

Apex Smelting Co. — — It is nice to know that we won't have to worry about them after July 1st.

Norwood Bridge — — As you know, the needed steel is to be rolled this month. However, there isn't a chance of the bridge being in place before the high water comes and goes; so we shall just have to pray for the best. The Highway Department seems to be prepared to replace the old one, if necessary.

Moab Bridge — — — Garard went to Salt Lake and got the Highway Department there to allow a 20-ton load over this bridge. As most of the heavier stuff has already passed over, the 20-ton load should see us through, until the bridge is strengthened. One would think they could get the necessary priority for the needed steel.

Navajo Indian Reservation I agree with you, as I said in my letter of April 17th, that there would be no need of tying up more ground on the reservation, until we have found something worth getting. I think then, we could get anything within reason. Garard has established a camp at Tee-nes-pah, having in some way secured the CCC Camp for nothing, and has three or four men prospecting.

/s/ ROBT. STERLING

[fol. 161]

[Handwritten notation—Cont'l Ore Corp.]

VANADIUM CORPORATION OF AMERICA

INTER-OFFICE COMMUNICATION

DATE March 14, 1942

FROM Gustav Laub

TO Mr. E. D. Bransome, President
SUBJECT APEX SMELTING COMPANY
Chicago, Illinois

Inasmuch as the following information has been conveyed verbally this memorandum therefore is for our records.

With reference to the writer's memorandum of February 20th advising that Mr. Christiansen, Vice President of the above company, had informed us that they were going out of the Vanadium business and had offered us their stocks of Vanadium raw materials, equipment, etc. as I had not heard further from Mr. Christiansen in this regard I had Larry Johnson casually contact him by phone and tell him that I had not received the information that he promised to send.

As a result, Mr. Christiansen phoned the writer and stated that in going into the matter further they had run into some legal difficulties. Mr. Leir, President of the Continental Ore Corporation, with whom Apex has an agreement to furnish their entire production of Vanadium, he acting as sales agent, objected strenuously to their breaching their contract and upon referring the matter to their counsel Apex were advised that Mr. Leir had a strong case against them and to make the most satisfactory arrangement with Mr. Leir that they could.

This resulted, Mr. Christiansen advised, in Mr. Leir putting a proposition up to them in that they would produce Vanadium at full capacity for a period of three months

after which time he would take over their equipment and raw materials contracts and produce the material himself.

Mr. Christiansen therefore advised that they felt they would be obligated to produce at maximum capacity for a period of three months and had decided to proceed on this basis but that they had not come to a definite conclusion about turning over the equipment and raw materials contracts after that time. The contract with Mr. Leir, he said, extended over the balance of the calendar year.

In event that the second part of Mr. Leir's proposition does not go through Mr. Christiansen stated that they still proposed to offer us such raw materials as they have available as well as plant equipment.

The above information, at your suggestion, was conveyed by phone to Mr. E. K. Jenekes, Assistant Chief, Vanadium Branch, War Production Board.

GL:ESW

[fol. 162]

SPECIAL REPORT
GUSTAV LAUB

April 14, 1942

APEX SMELTING COMPANY
Chicago, Illinois

Mr. Edward S. Christiansen—Vice President

With reference to the writer's previous report of February 20th, Mr. Christiansen of the above company called again yesterday stating that they had now gotten their Vanadium situation straightened out and that they had definitely concluded to dismantle their Vanadium plant at once and go out of the Vanadium business permanently. The equipment from their plant is now for sale. He doubted whether there would be much of the equipment that might interest us but said that the list of same would be sent to us promptly.

Mr. Christiansen stated that they had finally been able to come to an agreement with Mr. Leir of the Continental Ore Corporation, with whom they had a 14 year contract, to cancel the same. By doing so it was necessary for them, he said, to produce only enough Ferro Vanadium to complete two open orders which Mr. Leir had on his books and to continue producing Vanex (a mixture of Oxide and Aluminum which they have been supplying) up through June after which time they would be completely out of the Vanadium picture. Mr. Christiansen further stated that their contract and dealings with Mr. Leir had not proven at all satisfactory to them and that they regretted ever having gone into the business.

He further stated that he would furnish us with the names of all of their suppliers of Ores and Oxide; the principal ones apparently being Shattuck Chemical Company, and Nisley & Wilson. He appeared to be most anxious that we obtain these raw materials rather than the possibility of Mr. Leir's getting them and continuing in the Vanadium business.

We had an interesting discussion concerning low copper grained aluminum which they produce and release with necessary priority approval and I therefore turned him over to our Purchasing Department with regard to this item.

EWC

G. L.

[fol. 163]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 63

March 11, 1940

Vanadium Corporation of America
490 Lexington Avenue
New York, N. Y.

Gentlemen:

Please be good enough to let us have your very best price on quantity lots of Vanadium Pentoxide crushed to $\frac{1}{4}$ " and under. We desire this material for domestic consumption.

Your immediate response will be very much appreciated.

Very truly yours,
APEX SMELTING CO.

L. Lippa

LL:JB
Airmail

[fol. 164]

April 8, 1940

Vanadium Corporation of America,
490 Lexington Avenue,
New York, N. Y.

Gentlemen:

We enclose copy of letter written to you on March 11, to which we do not seem to have received a reply.

This, no doubt, has been overlooked and we would appreciate hearing from you.

Very truly yours,
APEX SMELTING CO.

L. Lippa.

Encl.
LL/r

[fol. 165]

[Letterhead of Vanadium Corporation of America,
New York, N. Y.]

April 20th 1940

[Stamp—Received—Apr 23 '40—1:30 PM—Apex Smelting
Co.]

Apex Smelting Co.
2537 W. Taylor Street
Chicago, Illinois

Attention: Mr. L. Lippa

Gentlemen:—

In response to your letter of April 8th enclosing copy of your letter of March 11th, which apparently went astray, would advise that our position is such that we have no material to offer you at present.

Yours very truly,

/s/ GUSTAV LAUB
Assistant Vice President

GL:IL

[fol. 166]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 75

[Western Union Form]

(25).

1944 JAN 13 PM 10 46

VB468 NL=GRAND JUNCTION COLO 13
CONTINENTAL ORE CO=
500 FIFTH AVE NYK=

WE CANNOT PURCHASE ORE 32 CENTS VANADIUM
CONTAINED AND SELL FOR 110. AM SENDING
COPY OF TELEGRAM TO HATCH. QUOTE REUR-
TEL. YOU STATE 52 CENTS IS CONTENT BASIS
AND TRANSFER COST IS 20 CENTS. GRANTED.
BUT WHEN ORE IS MILLED A PERCENTAGE OF
VALUES ARE LOST IN TAILINGS. ADD THE COST
OF THESE VALUES TO 20 CENTS AND WE STILL
WISH TO KNOW DIFFERENCE BETWEEN IT AND
OUR OFFER OF 26 CENTS. COST OF 32 CENTS CON-
TENT BASIS MAKES OUR RECOVERED VANADIUM
COST 46 CENTS PER POUND WHICH WE CANNOT
STAND. DURANGO WOULD HAVE A SIMILAR LOSS
AND A RAISE IN COSTS THEREFROM WHETHER
[fol. 167] FIGURED AS ADDITIONAL ORE COST AS
WE DO OR ADDITIONAL MILLING COST AS YOU
ARE APPARENTLY DOING. CONCERNING TAIL-
INGS ARMY HAS PLANT URAVAN RECOVERING
VALUES TAILINGS MUCH CLOSER TO GATEWAY.
WE HAVE TRIED TO GET RID OF 1500 TONS OUR
OLD TAILINGS CARRYING HIGHER VANADIUM
URANIUM CONTENTS THAN MRC OR URAVANS.
WE CANNOT SELL THEM SO FAR AT EVEN ONE
DOLLAR PER TON. WE QUESTION VALUE OF TAIL-
INGS AT PRESENT UNDER SUCH CIRCUMSTANCES
WE KNOW EXIST. WE SEE NO CURTAILMENT
PROGRAM TAKING PLACE OTHER THAN SHUT-
TING DOWN OUR PLANT WITH A NEW MRC OP-
ERATION AT RIFLE, CONTINUED OPERATION ALL

OTHER MRC PLANTS, CONTINUATION OF ORE PURCHASES AND ORE CONTRACTS. IT SEEMS TO [fol. 168] US DEFINITELY AND CLEARLY USV AS AGENTS ARE USING WPB CONTROL TO COMPLETELY MONOPOLIZE THE VANADIUM INDUSTRY. AS AGENTS THEY HAVE OUR ORE SUPPLY UNDER CONTRACT; AS AGENTS THEY KNOW OUR PRESENT OPERATING COSTS AND KNOW WE CANNOT OPERATE AT AN ORE COST OF 46 CENTS; AS AGENTS USV USED CURTAILMENT PROGRAM TO STOP OUR OPERATION AHEAD OF ANY OTHER PLANTS INCLUDING MRC PLANTS. WE RECEIVED NO DIRECTIVE FROM EITHER WPB OR MRC. WE WERE FORCED OUT OF PRIVATE PRODUCTION INTO MRC PROGRAM IF WE WISHED TO CONTINUE BUSINESS, THE THEORY BEING THAT THE MRC PROGRAM WAS NECESSARY FOR THE WAR EFFORT. NOW THE AGENTS ARE CONTINUING THEIR PROGRAM OF COMPLETELY MONOPOLIZING THE INDUSTRY WITH THE AID OF THE WPB AND MRC REGULATIONS. IF THIS IS NOT THE [fol. 169] CASE WHY SHOULD WE BE THE FIRST AND ONLY PLANT TO BE SHUT DOWN, WHY SHOULD WE BE THE ONLY PLANT PENALIZED BY THE MRC AND WPB PROGRAM. IF THERE IS NO FURTHER JUSTIFICATION FOR PRODUCING VANADIUM IN EXCESS OF REQUIREMENTS WHY ARE NOT GOVERNMENT PLANTS CLOSED FIRST INSTEAD OF PRIVATE OWNED PLANTS AND ESPECIALLY WHY ISNT THE PURCHASE OF ORE STOPPED. WE REALIZE THAT WE ARE SMALL PRODUCERS NOT APPRECIABLY AFFECTING VANADIUM PRODUCTION AS A WHOLE YET OUR LITTLE BUSINESS IS GOING PART OF THE AMERICA WE ARE FIGHTING FOR. IF THE USV IS GOING [fol. 170] TO TAKE ADVANTAGE OF THESE WAR CONDITIONS TOGETHER WITH MRC AND WPB AID TO COMPLETELY MONOPOLIZE THE INDUSTRY AND FORCE ALL OTHERS TO DISCONTINUE BUSINESS IT MAKES US WONDER JUST WHAT OUR BOYS ARE FIGHTING FOR=

NISLEY AND WILSON VANADIUM MILL.

[fol. 171]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 76

NISLEY & WILSON VANADIUM MILL

GATEWAY, COLORADO

January 31, 1944

Mr Henry J Leir
Continental Ore Company
New York, New York.

Dear Mr Leir:

As you know, Mr Gardner, Mr Wilson and myself are owners and operators of the Gateway plant. Mr Gardner has the old plant, and Mr Wilson and myself have added considerable new equipment and have been operating under a contract with Mr Gardner.

Since the curtailment of Vanadium production and the lessening need for it, I have been called to the service. This will affect our contract with Mr Gardner. Since the plant cannot be operated at the present time, and it doesn't look as if it could for quite sometime, we are going to have to sell either our interest in the plant, or dismantle it. Since I must leave shortly, we are going to have to act quickly.

We are all very sorry to have to discontinue, but we see no other way out at present. Mr Gardner has taken an active interest in the operation and has helped us in getting our problems straightened out. The local M.R.C. told us that the mill had made a very good extraction, in fact better than some of the others under the M.R.C. The cake was of good quality. We had a very satisfactory operation during December, especially.

The big mill at Uravan was closed down last Sat night and they are letting a number of their men go. Their other

plants are still operating full blast however. We do not believe that they will ever let the price of the crude ore adjust wo where we could operate at \$1.10 again, at least for quite some time.

Concerning our bill with you, we will get things straightened out shortly and send you a check. We would like to have you also include the amount we owe you for this year so it can all be straightened out at once.

We want you to know we sincerely appreciate all you have done for us in the past. We have never had business dealings with anyone who has treated us any finer than you and we really do appreciate your cooperation and help. We sincerely wish we could continue to do business with you.

Sincerely yours,

/s/ FRANK NISLEY JR.

[fol. 172]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 77

June 14, 1941

Mr. C. G. Roser
Electro Metallurgical Company
30 East 42nd Street
New York City

Dear Mr. Roser:

RE: VANADIC ACID

Please let us have your offer of the above material for shipment to the Apex Smelting Company, of Chicago.

Yours very truly,

CONTINENTAL ORE CORPORATION

President

Henry J. Leir/re

[fol. 173]

June 16, 1941

Electro Metallurgical Company
30 East 42nd Street
New York City

Attention: Mr. F. P. Gormely, General Manager

Gentlemen:

As you know, the Apex Smelting Company of Chicago has been in the aluminum smelting business for more than 20 years.

Last year they entered into the production of certain ferro alloys by the alumino-thermic process, and have created good facilities for this particular manufacture which, if necessary, could be easily enlarged.

Would you be interested in "farming out" a certain quantity of vanadic acid, and allow us to convert it for your account into low carbon ferro vanadium?

We shall be awaiting the pleasure of your reply to the above suggestion, and hold ourselves at your disposal for any personal discussion you might like to have on this subject.

Yours very truly,

CONTINENTAL ORE CORPORATION

President

Henry J. Leir/re

[fol. 174]

[Letterhead of Electro Metallurgical Company,
New York, New York]

July 31, 1941

Mr. Henry J. Leir, President
Continental Ore Corporation
500 Fifth Avenue
New York City, N. Y.

Dear Sir:

Please pardon the delay in replying to your letter of June 16 asking if we would be interested in having you convert a certain quantity of vanadic acid for our account into low carbon ferro vanadium.

I have reviewed this matter several times with my associates and find that we are at the moment able to smelt all the vanadic acid which we have available. Should this situation change we will be glad to get in touch with you but see no prospects at the moment that we would be interested in your proposal.

Very truly yours,

ELECTRO METALLURGICAL COMPANY

/s/ F. P. GORMELY

Vice-President and General Manager

FPGormely:O

[fol. 175]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 78

VANADIUM CORPORATION OF AMERICA

INTER-OFFICE COMMUNICATION

DATE Feb. 14, 1947

FROM P. J. Gibbons,
Executive Vice President

TO Mr. J. B. Girdler, Asst. Gen. Mgr. of Sales

SUBJECT Continental Ore Co. Inquiry

With reference to letter from the Continental Ore Co. dated Feb. 11, 1947, in which they advise they would be interested in one minimum carload per month of vanadium pentoxide for delivery commencing with April and through July 1947, after study of existing commitments for this commodity and the sales estimate supplied to me by the Sales Department covering the current year we find our entire production capacity will be taken up for the year 1947.

However, it is possible that we may be able to supply a car during the period mentioned if we were called upon for it but at this time we could not guarantee even that amount.

/s/ P. J. GIBBONS
Executive Vice President

G-T

[fol. 176]

February 24, 1947

Continental Ore Company
500 Fifth Avenue
New York-18-New York

Attention: Mr. Joel A. Mirel

Gentlemen:

With reference to your letter of February 11, 1947 with respect to contracting for one carload per month of Black Vanadium Oxide, Fused, beginning in April and through July, 1947, i.e. four carloads, after reviewing our existing commitments for this commodity and estimated sales, we believe that we will be able to take care of these four carloads if delivery is extended over a six months' period beginning with April, 1947.

Our present contract price for Fused Black Vanadium Oxide is

\$1.10 per pound contained V_2O_5

F.O.B. seller's works, Bridgeville, Pennsylvania, with freight charges allowed to destination, unless such freight charges are in excess of the rate to St. Louis, Missouri. In such case, freight charges to St. Louis will be allowed.

The above price will be in effect until March 31, 1947 and thereafter for each calendar quarter-year unless revised in writing by us at least fifteen days prior to such quarter-year.

This offer, which is subject to our usual contract terms, is subject to acceptance by execution of our formal contract on or before March 15, 1947, so would ask that you advise us promptly whether or not you are interested in having us submit our contract to cover the tonnage above mentioned.

Very truly yours,

John B. Girdler
Assistant General Manager of Sales

JBG:DEW

[fol. 177]

CONTINENTAL ORE COMPANY

500 FIFTH AVENUE
NEW YORK 18, N. Y.

March 7, 1947

Vanadium Corporation of America
Graybar Building
420 Lexington Avenue
New York 17, New York

Att: Mr. John B. Girdler

Re: Black Vanadium Oxide

Gentlemen:

Receipt is acknowledged of your letter dated February 24, in which you submit us your proposal for four carloads of Black Vanadium Oxide at the contract price of \$1.10 per pound contained V_2O_5 f.o.b. your works, Bridgeville, Pennsylvania with freight charges allowed to destination, unless such freight charges are in excess of the rate to St. Louis, Missouri. In such case freight charges to St. Louis will be allowed.

We have submitted your proposal to our buyers and have been informed that our price is out of line with current market offerings. From what we have been able to ascertain in our subsequent discussions, the oxide would have to be made available to us around \$1.00 to \$1.05 in order to permit doing the business. We would thank you to give consideration to a revision in your price to conform with the price indicated above as we believe prospects appear favorable for doing the business at our indicated figure.

Very truly yours,

CONTINENTAL ORE COMPANY

/s/ JOEL A. MIREL
J. A. Mirel

JAM/vi

[Stamp—Mar. 10, 1947—Sales Dept.]

[fol. 178]

[Stamp—To WAM✓—GL✓—JBG✓—JHM✓—RHF✓—
AJS✓—Return to JBG]

[Handwritten notation—file]

March 13, 1947

Continental Ore Company
500 Fifth Avenue
New York 18, New York

Attention: Mr. J. A. Mirel

Gentlemen:

With reference to your letter of March 7 relative to our offer to sell Black Vanadium Oxide Fused, we regret that you are not interested in our proposal for the sale of this material at \$1.10 per pound contained V_2O_5 as quoted in our letter of February 24.

We are not prepared at this time to consider making a reduction in our current prices.

Very truly yours,

John B. Girdler
Assistant General Manager of Sales

JBG:HK

[fol. 179]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 111

[Letterhead of Climax Molybdenum Company,
New York, New York]

February 10, 1943

Mr. Henry J. Leir, President
Continental Ore Company
500 Fifth Avenue
New York, N. Y.

Subject: Ferrovandium

Dear Sir:

In reply to your letter of February 8th we herewith submit to you, in duplicate, the following contract offer with the understanding that your acceptance at the place designated therefor at the bottom hereof shall constitute a mutual binding agreement between us, our successors and assigns.

- 1) You will ship to us at Langeloth, Pennsylvania, freight prepaid, 20,000 pounds of contained V in a V_2O_5 concentrate, to which you now have title.
- 2) You will ship to us adequate low copper aluminum to make it possible for us to produce ferrovandium from the V_2O_5 .
- 3) We shall convert the V_2O_5 into ferrovandium, using our own labor, equipment and supervision.
- 4) We shall pack and deliver to you, f.o.b. Langeloth, Pennsylvania, into suitable fiber containers, all of the ferrovandium produced as a result of this operation.
- 5) You will pay to us the following amounts:

- a—Twenty cents (20¢) for each pound of vanadium contained in the ferro-vanadium returned to you.
- b—Costs of fluxing materials necessary, such as lime and fluorspar.
- c—Costs of containers and labor for packing such ferrovanadium.
- d—It is understood that we shall pursue this matter with all diligence but do not guarantee any specific delivery date nor a minimum percentage recovery. The usual Force Majeure clause will apply to this agreement. We expect to complete this program during the month of March 1943.

Kindly return to us the duplicate of this contract after you have executed same.

Very truly yours

CLIMAX MOLYBDENUM COMPANY
OF PENNSYLVANIA

/s/ A. LINZ
Arthur Linz
Vice President

AL:JMM

ACCEPTED:

CONTINENTAL ORE COMPANY

By President.

[fol. 180]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 113

[Handwritten notation—W P B]

WAR PRODUCTION BOARD

WASHINGTON, D. C.

November 10, 1943

IN REPLY REFER TO:

F-A EFH 1013-SSB

Mr. W. G. Haldane
Assistant General Superintendent
United States Vanadium Corporation
30 East 42nd Street
New York, New York

Dear Mr. Haldane:

This is to acknowledge your letter of October 29th requesting that the restrictions placed upon vanadium immediately be removed in accordance with the expressions of opinion at the Vanadium Industry Advisory Committee Meeting held on October 25, 1943.

I should also like to reiterate the understanding reached at the meeting that in view of present supply-demand situation in vanadium all requests, implied or otherwise, to maintain maximum production have been withdrawn insofar as vanadium, itself, is concerned.

The Ferro-Alloys Branch of the Steel Division has started the procedure to remove vanadium from allocation as requested by the Vanadium Industry Advisory Committee. We are unable to advise you what disposition will be made of this matter, but hope that favorable action will be taken in the near future. With respect to the further

recommendations by the Committee, these have been referred to the proper authorities for consideration.

Very truly yours,

/s/ E. FRANKLIN HATCH

E. Franklin Hatch
Assistant Chief
Ferro-Alloys Branch

[fol. 181]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 114

[Letterhead of Imperial Paper and Color Corporation,
Glens Falls, N. Y.]

DECEMBER 5, 1944.

Continental Ore Company,
500 Fifth Avenue,
New York 18, N. Y.

Attention—Mr. M. Wolf

Gentlemen:—

Replying to your letter of December 4th, we are writing to advise you that we are not willing to write a letter such as you suggest at this time, because it might be construed as a representation that would involve an obligation that we do not care to assume. It is true that with the manpower situation as it is, we could not proceed with the Vanadium project, aside from all other considerations, but it is also true that if the manpower situation were easier, we would have to have more confirmation than we have been able so far to obtain that there are, and always will be, ample sources of vanadium-bearing material, so that if we invested capital in a plant, we would not sooner or later find ourselves with equipment idle, because of being unable to secure necessary raw materials.

We now have some leads out to see what we can determine as to the probable operation of the Otavi mines after the cessation of hostilities in Europe. Mr. Leir on his proposed trip to Mexico ought to be able to establish whether there is a new source of vanadium-bearing ore available in that country, and if so, in what quantities and in what concentrations.

As we see this situation at the present time, one of the principal hazards in entering into the manufacture of V_2O_5 is the possibility that you may not be able to get sufficient raw material. Certainly the two major producers at this time have protected themselves against such a contingency by controlling primary sources of raw material. We would not be willing at the outset at least to make an investment of the size necessary to do this, but nevertheless we must be sure that there are sources from whom we can always obtain vanadium-bearing materials at a price which will enable us to manufacture and compete with those who control their own supplies.

Yours very truly,

IMPERIAL PAPER AND COLOR CORPORATION

/s/ A. F. BROWN

General Manager

Pigment Color Division

AFB:AEG

[fol. 182]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT NO. 116

February 19, 1943

File: Stimmel
U.S. Vanadium
Vanadium Corporation of America
Nisley & Wilson

Stimmel confirmed that present production of ferro vanadium amounts to about

400,000 lbs. V per month

They are trying to build up a stock pile of ferro to the extent of at least 500,000 lbs. of V. Once this is achieved, they may release their restrictions as to the sale of ferro-vanadium somewhat.

Regarding quantities of vanadium concentrates available in Durango or Monticello for shipment to us, Stimmel said that it has been agreed between Metals Reserve and U.S. Vanadium and Vanadium Corp. respectively that

U.S. Vanadium has first call on all material produced in Durango Vanadium Corp. of America has first call on all material produced in Monticello.

As to who would have first call on the vanadium concentrates produced by Nisley & Wilson, Stimmel answered that probably no one would have. It therefore must be our aim to have Metals Reserve recognize our first right on the production at Gateway.

mw/sk

[fol. 183]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 127

[Handwritten notations—9-486—124—dash]

[Stamp—Received—Apex Smelting Co.—Jan 14 1942—
8:30 A.M.]

CONTINENTAL ORE CORPORATION

TO Apex Smelting Company

SUBJECT RE: NISLEY & WILSON VANADIUM/
SHATTUCK

DATE

1/13/42

Attention: Mr. L. Lippa

We are very sorry to learn from your correspondence that Blanding has sold its output to Vanadium Corp.

This makes it even more imperative that you promptly write to Nisley & Wilson to ship the material now ready to you without further delay.

We also want to stress the necessity of sending the proposed letter out to the Vanadium Corp. It becomes more and more necessary every day to obtain a share from them, of the output of the new Government plant in Monticello, and we cannot pave the way for this too early.

Regarding SHATTUCK, we suggest that you approach them and offer them a contract for larger monthly quantities than they have at present from you, in order to induce them to increase their output.

We consider this most important, since they are now the only regular source of Vanadium we have.

CONTINENTAL ORE CORPORATION

/s/ HENRY J. LEIR

RK

Henry J. Leir/rk

[fol. 184]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 128

CONTINENTAL ORE CORP Room 1717
500 FIFTH AVE

[Western Union Form]

OCTOBER 17 1940

APEX SMELTING COMPANY
2537 WEST TAYLOR STREET
CHICAGO ILLBEFORE WRITING VANADIUM CORPORATION
PLEASE AWAIT OUR TODAYS LETTER

CONTINENTAL ORE CORPORATION

[fol. 185]

[Letterhead of Apex Smelting Co., Chicago, Ill.]

October 17, 1940

Continental Ore Corporation,
500 Fifth Avenue,
New York, N.Y.

Gentlemen:

We have your letter of the 16th, also wire of the 17th, and wish to advise that we had no intentions of writing the Vanadium Corporation in view of the fact that we did write to them about two months ago, at which time they advised us that they did not have any of this material to offer.

The Electro Metallurgical's representative was in our office today at which time we mentioned this to him, and while

he advised that their price was \$1.15, he said they could not take on any new accounts.

We wish to advise that it is possible we may receive a shipment of approximately 4000~~±~~ of Vanadic Acid from Shattuck within the next few weeks. The price will be \$1.10.

We have just checked up our figures on the heat made to Braeburn Steel, and according to our figures the profit to us is \$25.00 after deducting your commission but before paying the freight. Therefore, it would indicate that the profit on this heat will be about \$15.00.

Our cost figures will be sent to you on this 70 to 80% grade as soon as we get our 40% figures together.

We, therefore, want to again state that we do not want to accept any orders under \$2.75; in fact we feel that for this grade there should be no difficulty in obtaining \$2.80, and we hope that you will act accordingly.

Very truly yours,

APEX SMELTING CO.

w/s/ L. LIPPA
L. Lippa.

LL/r

[fol. 186]

PLAINTIFFS' EXHIBIT No. 135

August 17, 1942

Vitro Manufacturing Co.
Corliss Station
Pittsburgh, Pennsylvania

Gentlemen:

Att: Mr. A.J. Strod, Sales Manager

Re: VANADIC ACID

We refer to our recent correspondence regarding the above and would like to know whether you are now in a position to supply us with some of your vanadic acid.

We are open for any quantity between five and fifteen thousand pounds per month and wish to inform you that our price schedule of June 1 (see our letter of June 30) is still in force.

May we hear from you soon?

Very truly yours

CONTINENTAL ORE CORPORATION

Martin Wolf

mw:sk

[fol. 187]

[Letterhead of The Vitro Manufacturing Company,
Pittsburgh, Pennsylvania]

August 19, 1942

Continental Ore Corporation
500 Fifth Avenue
New York, New York

Attention: Mr. Martin Wolf

Gentlemen:

We acknowledge with thanks receipt of your two letters of August 17.

VANADIC ACID. Present arrangements covering deliveries of our entire production of Vanadic Acid would not permit us the sale of this material in other directions. The arrangements are made for a long term, and so for some time, we will not be able to furnish any Vanadium compound to outside users.

WULFENITE. The sample of Wulfenite you recently sent us is now in the process of investigation; and as soon as we have the data together on the possibilities of the separation of the Molybdenum and Vanadium, we will immediately contact you. The process is rather involved and it will take us a little time before a practical conclusion can be arrived at. Wulfenite appears to be a useful product, and we will make every effort to work out a scheme for separating the useful materials contained.

Yours very truly,

THE VITRO MANUFACTURING COMPANY

/s/ A. J. STROD

A. J. Strod, Vice President

AJS:BAP

[fol. 188]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 142

May 25, 1938

Mr. Robert E. Adams
1436 Ute Ave.
Grand Junction
Colorado

Dear Sir:

Re: Carnotite ores and Vanadium concentrates

We are indebted for your address to the Bureau of Mines, Washington, D. C. and would like to know your position in regard to selling us the above materials which we intend to buy regularly.

As we are an independent firm, you may be interested in entering into such a relationship with us.

We will be very glad to hear from you on this matter, and remain

Very truly yours,

APEX SMELTING Co.

L. Lippa

LL:JB

[fol. 189]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 145

[Stamp—Received—Apex Smelting Co.—Dec 26 1941—
8:30 A.M.]

[Letterhead of Defense Plant Corporation,
Washington, D. C.]

December 20, 1941

Mr. L. Lipa
The Apex Smelting Company
2537 W. Taylor Street
Chicago, Illinois

Dear Mr. Lipa:

Reference is made to your letter of December 13, 1941, requesting information as to the possibility of acquiring reasonable tonnage of Vanadium Pentoxide for conversion into Ferro Vanadium.

This Corporation has made a commitment to the Vanadium Corporation of America for the construction of a new plant near Monticello, Utah, for the production of Vanadium Pentoxide. The entire facilities of this plant will be leased to the Vanadium Corporation, and, therefore, it is suggested that you contact them with reference to obtaining a portion of the output of this proposed plant.

It is further suggested that if you have not already obtained a priority allocation for Vanadium Pentoxide that you contact Mr. H. K. Masters, Office of Production Management, Social Security Building, Washington, D. C., relative to obtaining such allocation.

[Handwritten notation—Last paragraph struck through and signed W. Boyer]

Yours very truly,

/s/ JOHN W. SNYDER
Executive Vice President

[fol. 190]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 147

UNITED STATES VANADIUM CORP. AGENT

METALS RESERVE CO.

GRAND JUNCTION, COLO.

9/17/43

Dear Page:

Please ask Cecil to stop at Thompsons when ever convenient to do some welding on their reversible conveyor.

Before Bill Lass went to Dove Creek I told him 96¢ per hr. was all we could pay a blacksmith. He understand, I'll speak to him again when I see him; I know he is tops and I hope he can stay on with us.

Blanding hasn't pd us on the Howell-Bay compressor. [fol. 191] I'll remind them. I'm haven't heard from Charlie or Mr. Cunningham. Have they been there.

I've been trying to call P Denny about the ore prices. No Connections.

I wonder if anything could be gained by meeting with Denny and Mr. Brannsome about the Ore Prices?

I'll try and get the Chandler-Shumway deal out to you to-morrow.

Regards,

/s/ JOHN

[fol. 192]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 148

Inter-Company Correspondence
COMPANY U.S.V.-M.R.C. LOCATION Monticello, Utah.

To Mr. John W. Hill,

LOCATION Grand Junction, Colorado.

DATE February 4, 1944.

[Handwritten notation—Sent to Monticello]

Dear John:

M. L. Nielson was in today and said that he had not received a contract cancelation. He appeared to feel slighted in the matter. I told him his contract would apply to the notice on the bulletin board. However, it might be well to send him a formal cancelation as we have with the rest of the producers in the country.

Wade & Curran were in today, not to see me, but to see Mr. Bransome and Denny. They were quite put out regarding the whole matter and said they did not feel that their contract was subject to cancelation. Mr. Bransome is familiar with our general form and if their contract is on one of our O.P.A. forms Mr. Bransome felt that there was no question that the contract is automatically canceled when we stop receiving ore. Evidently their next move is to see Dan Melinskie in Cortez.

All of this to merely keep you posted as to your friend's activities.

Sincerely,

/s/ PAGE

Page Edwards.

E-h.

Personal

[fol. 193]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 152

CONTRACT

THIS AGREEMENT Made and executed this 7th day of May, 1940, by and between MESA VANADIUM COMPANY, a corporation organized and existing under the laws of the State of Colorado, with its principal office located in Grand Junction, Colorado, party of the first part, and the UNITED STATES VANADIUM CORPORATION, a corporation existing under the laws of the State of Delaware, with its principal Colorado office located at Uravan, Colorado, party of the second part, WITNESSETH:

WHEREAS, The first party is the owner under contract of purchase of a certain mill located near Cedar, Colorado, and is desirous of arranging for the operation of the said mill for the treatment of carnotite ores; and

WHEREAS, Second party is interested in the possibilities of the use of said mill for the milling of carnotite ores;.

NOW, THEREFORE, In consideration of the mutual covenants of the parties and the payments to be made by the second party to the first party, the first party grants unto the second party the sole right to enter upon the said property for the period of sixty days from the date of this agreement, to make such examination and experimental work as it may deem fit and to conduct such metallurgical test work or operation as second party deems sufficient or necessary.

It is agreed that the second party has the option on or before the expiration of said sixty-day period to operate said mill and to make such alterations and additions at its expense as are necessary, and otherwise to conduct the business of the reduction of ore or ores therein; and the right so to do is hereby granted.

[fol. 194] In the event that second party shall exercise its option to operate, it agrees to pay the first party a

sum equal to ten cents per lb. of vanadium pentoxide produced as a result of said operation.

Second party agrees that in the event it exercises its option to operate first party's mill, second party will pay all cost of operation, including the costs of ores delivered at the plant, working men's compensation, insurance premium on mill buildings to a total insured value of \$6000.00, and will pay such taxes as may be assessed against the property during the period in which the mill is operated; and second party further agrees to pay the sum of \$4000.00 to first party at the time second party exercises the option to operate, which sum is to apply on the royalty of ten cents per lb. of vanadium pentoxide produced as herein provided; and second party agrees that in the event it shall operate said plant, it will operate the same to the maximum capacity that is reasonably possible.

It is further provided, however, that in the event second party shall exercise said option to operate, and shall thereafter fail to operate the property for a period of thirty days and this failure is not due to flood, fire or act of God, the first party may at its option terminate the tenancy of second party upon written notice to be given second party at Uravan, Colorado, which notice shall provide, however, that second party shall have a thirty-day period after the receipt of notice to correct second party's deficiency.

It is further agreed that in the event the second party after operating said property decides the operation should not be continued for reasons which are good and sufficient to itself and of which reasons second party shall be the sole judge, then the mill of first party shall revert to first party and any additions and improvements that have been made to the mill shall become the property of the first party as liquidated damage.

[fol. 195] It is further agreed that if after the period of sixty days' examination hereinbefore provided, the second party shall option not to operate the mill, the second party shall have the right to purchase from first party such ore or ores as may be delivered or stockpiled at the mill at a price to be determined as follows, to-wit: The price shall be the cost to first party or to second party acting as agent for the purchase of the ores, plus five cents per lb. of 75%

of the vanadium pentoxide contained; and it is further agreed that in the event the second party elects to purchase such ores at the end of the sixty-day period for examination and experimental work, it agrees to pay first party the sum of \$4000.00, which amount shall be applied as an advance payment on the royalty of five cents per lb. for 75% of the vanadium pentoxide contained in these ores.

IN WITNESS WHEREOF The parties have hereunto set their hands and seals by their officers and agents first authorized so to do.

MESA VANADIUM COMPANY

By /s/ COE VANDEREN

President

[SEAL]

/s/ CHARLES H. BUTTOLPH

Secretary

First Party

UNITED STATES VANADIUM CORPORATION

By /s/ W. G. HALDANE

[Signature illegible]

Second Party

[fol. 196]

CONTRACT

THIS AGREEMENT Made and executed this 7th day of May, 1940, by and between MESA VANADIUM COMPANY, a corporation organized and existing under the laws of the State of Colorado, with its principal office located in Grand Junction, Colorado, party of the first part, and the UNITED STATES VANADIUM CORPORATION, a corporation existing under the laws of the State of Delaware, with its principal Colorado office located at Uravan, Colorado, party of the second part, WITNESSETH:

That first party is the owner of a certain mining lease and option dated August 5, 1939, together with an addenda to mining lease and option dated April 22, 1940, executed with one George A. McKee, covering carnotite claims in San Miguel and Montrose Counties, Colorado, and is desirous of selling ore which it has a right to obtain or mine under the said lease and option; and the party of the second part is desirous of purchasing the said ores from the first party;

NOW, THEREFORE, In consideration of the mutual agreements of the parties and the payments to be made by second party, IT IS AGREED:

First party will deliver to second party at the mine such ores as may be mined or delivered from said claims at a price to be determined as follows:

A. In case the ores are mined by George A. McKee under the terms of the lease and option above referred to, the price of the ore shall be the amount to be paid by first party to George A. McKee, plus a further consideration of 5¢ per lb. for 75% of the vanadium pentoxide (V₂O₅) contained in said ore.

B. In case the ores are mined by the first party, or by its agents or lessees, the price shall be the entire cost of mining and transportation to the delivery point specified in the said McKee lease and option, plus a royalty of 10% of the value of the ore thus delivered; and said values are determined as set forth in the McKee lease and option in regard to the initial 1000 tons mined, i. e.;

[fol. 197] For ores containing between 2 and 3% vanadium pentoxide (V₂O₅) \$8.00 per net dry ton;

For ores containing between 3 and 4% vanadium pentoxide (V₂O₅) \$15.00 per net dry ton;

For ores containing between 4 and 5% vanadium pentoxide (V₂O₅) \$21.00 per net dry ton;

For ores containing between 5 and 6% vanadium pentoxide (V₂O₅) \$32.00 per net dry ton;

And for ores bearing over 6% vanadium pentoxide (V2O5) as set forth in said McKee lease and option.

It is understood and agreed that the above mentioned 10% royalty is payable to George A. McKee under the terms of a recent option between George A. McKee and first party as assignee of Charles H. Buttolph.

Second party agrees to pay first party in addition an amount equal to 5¢ per lb. for 75% of the contained vanadium pentoxide in said ore.

The party of the second part agrees to purchase said ores at the rate of production, provided for in the above mentioned lease and option with George A. McKee, unless this agreement is terminated as hereinafter provided.

The party of the second part agrees to pay the first party \$1000.00 upon the execution of this agreement and an additional \$5000.00 at the end of ninety days, said payments to be applied on royalties as hereinafter provided; that is to say, said \$6000.00 shall be advance payment against the royalty of 5¢ per lb. of 75% of the contained vanadium.

The party of the second part reserves the right to cancel this agreement at any time within the life of the McKee lease and option; provided that, in the event of such cancellation, any amounts or difference between the \$6000.00 paid by second party to first party and the amount which is due first party on the basis of 5¢ per lb. of 75% of vanadium contained shall become the property of the first party in full liquidation of any loss or damage arising out of the cancellation of this agreement by second party.

It is understood and agreed that second party shall have the option to mine and remove ores, under the terms of the lease and option granted by George A. McKee, as the agent [fol. 198] or representative and in the place of first party; and in the event that second party shall exercise this option to mine and remove ores, it shall carry Workmen's Compensation on all employees and keep the property free from lien or encumbrance, and shall in addition perform such work as may be required for annual assessment on said McKee claims, and cause affidavits thereof to be filed as provided by law, pay before delinquent any current taxes

levied against said claims, and in all other respects preserve the claims as provided for in the said lease and option executed between George A. McKee and first party as assignee of Charles H. Buttolph.

IN WITNESS WHEREOF The parties have hereunto set their hands and seals by their officers and agents first authorized so to do.

MESA VANADIUM COMPANY

By /s/ COE VANDEREN

President

/s/ CHARLES H. BUTTOLPH

Secretary

First Party

UNITED STATES VANADIUM CORPORATION

By

Second Party

[fol. 199]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT NO. 155

[Handwritten notation—Mr. Haldane]

COPY

New York, N. Y.

October 13, 1943.

E. M. SALES CORPORATION

Mr. J. D. Swain,
Room 1712, Bldg.

Mr. J. H. Critchett
Mr. F. P. Gormely
Mr. J. M. Price
Mr. J. R. Van Fleet

Dear Mr. Swain:

The net result of our discussion in Washington on the subject of vanadium and tungsten during the past week may be stated as follows:

A meeting of the Industry Advisory Committee is scheduled for 2 PM, October 25th to approve certain proposals that will be presented at such time, (since WPB had already discussed this date with others, it was impossible to have the meeting called for an earlier date.) The purpose of the meeting will be:

1. to rescind the directive requiring vanadium producers to mine to the fullest extent of their capacity.

2. to propose the removal of ferrovanadium, ferro-tungsten, tungsten ore, vanadium oxide and tungsten metal powder from an allocation basis. (Steps are being taken by WPB in anticipation of this meeting to have these allocations removed. It is estimated by WPB that allocations may be no longer required by December 1st.)

3. to make recommendations to be passed on by the Steel Division of WPB for any extended applications of vanadium which producers may feel are justified. (The Vanadium Branch has solicited the assistance of the producers in making these recommendations, which may be a rather difficult assignment for the producer should the Steel Branch ask for specific applications.)

4. to receive a report from the Army concerning the minimum requirements of vanadium production that are necessary to supply their needs of by-product. The vanadium oxide producers will be asked the same question; namely, the minimum production to which they can go without curtailing Army needs. WPB proposes that if industrial requirements are substantially less than the necessary production for Army needs they would ask the Army to purchase the surplus oxide for a stockpile of their own. Mr. Lewis Levansaler who replaced Mr. E. F. Hatch as the vanadium and tungsten ore man in WPB made an informal comment at luncheon that in his opinion it was necessary to curtail vanadium oxide production to such a point where it would be necessary to begin working away a portion of the huge accumulation of oxide and ferrovanadium each month.) It was generally agreed that the net result from satisfactory action taken on items 2 and 3 would not affect to any great extent the present sales of vanadium or tungsten.

The present order requiring that not more than 35% of the sales of high speed steel be in the form of 18-4-1 tungsten type and not less than 65% of the sales of any one producer be in the form of molybdenum type steel will probably be brought up for discussion at this meeting. The Industry Advisory Committee will probably be asked for an expression of opinion and perhaps a recommendation for a modification or discontinuance of this order.

[fol. 200] The details of a lend-lease order for Russia specifying 200 gross tons of 70/80% "B" grade ferrovanadium were discussed. We quoted a price of \$2.90 per pound of contained vanadium F.O.B. Niagara Falls, N. Y., with freight charges allowed to destination, except to those

points taking a freight rate in excess of the Niagara Falls to St. Louis, Missouri rate, for each of the following compositions:

	50-60% Vanadium		70-80% Vanadium	
Aluminum	1.25%	maximum	1.25%	maximum
Silicon	1.25%	"	2.00%	"
Carbon20%	"	.20%	"
Phosphorus10%	"	.10%	"
Sulphur10%	"	.10%	"

WPB was advised that delivery could be expedited through the specification of the 50/60% grade because such analysis is in regular production. We also advised them that should the order become available to us within the next week or ten days we could produce approximately 100 gross tons by December 31, 1943. WPB plans to divide the total order between our competitors and ourselves on the basis of our respective production of vanadium during the past three or possibly six months.

We have learned that our competitors have advised WPB that they wish to dispose of, through government agencies, 250,000 pounds of contained vanadium in the form of ferro between now and the end of this year. In response to a similar question asked of us, I replied that I could not give them specific figures offhand, but I estimated that we too would like to move from 200,000 to 250,000 pounds of contained vanadium. I returned to WPB at the close of the Production Adjustment Committee meeting and learned that they had approved the 200 ton lend-lease requirement, and in addition had approved an additional sale of ferrovanadium by us to the Metals Reserve Company to complete a total of approximately 225,000 pounds of contained vanadium prior to the end of this year. Presenting this matter to the Committee was done by Mr. Miles K. Smith on his own initiative in order to clear the "first hurdle", so he described it, on any request for additional orders for ferrovanadium from Metals Reserve prior to the end of this year. It will be necessary for us to apply formally should we wish to sell any additional vanadium to Metals Reserve. We plan to withhold any formal application for

an order until such time when we have more specific information as to the portion of the lend-lease requirements which may be directed our way.

Very truly yours,

W. B. REMMERS

[fol. 201]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 156

[Stamp—Received—Apex Smelting Co.—Nov 22 1941—
8:30 AM]

DANIEL MILENSKI

Attorney-at-Law
CORTEZ, COLORADO

Nov. 19, 1941

Apex Smelting Co.
2537 W. Taylor Street
Chicago, Illinois

Dear Sir:

Upon my return, I find that Bigler has sauntered off to Denver to see a football game, he will return Saturday.

As we pay a royalty to the owner of the claims, I have advised him of your offer, and will undoubtedly hear from him by the first of the week.

The product that we have ready for shipment is moulded, not ground. We would much prefer not grinding it as it will take additional equipment which we are not particularly anxious buy. However we might make some arrangements to grind it if absolutely necessary.

We particularly like the sound of that \$1.05.

With best regards,

/s/ DAN MILENSKI

[fol. 202]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 159

[Stamp—Received—Apex Smelting Co.—Feb (day illegible) 1942—8:30 AM]

BLANDING MINES COMPANY
(OF UTAH)

Mail Address:

P. O. Box 895
Cortez, Colorado

February 23, 1942

Apex Smelting Co.
2537 West Taylor St.
Chicago, Illinois

Gentlemen:

We have your wire of February 14 and letter confirming the wire. No report was made at an earlier date for the reason that we were endeavoring to become more familiar with the situation.

As we take the letter we received from the War Department, we are not directed to sell our product to you, and as previously advised, other arrangements have been made for the sale of our product and we have informed the War Production Board that we desire to continue with our present sales arrangement.

We regret that we are unable to sell our product to you; however, you are aware of our set-up and the fact that we are merely operating under a lease. We are producing now under somewhat of a handicap for the reason of adverse climatic conditions with result of poor roads.

Very truly yours

BLANDING MINES COMPANY

By /s/ L. EATON
Ass't Secretary

[fol. 203]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 161

[Stamp—Received at 420 Lexington Ave. N. Y.—MOhawk
4-0950]

[Postal Telegraph Form]

NA46 55 VIA FRENCH=PARIS OCT 4 1939 1010A

LC BRANSOME VANCORAM NEWYORK US (BRAN-
SOME CARE VANADIUM CORP OF AMA FURTHER
YOUR CABLE TWENTYSEVENTH STOP BEING
LONDON LAST WEK HAVE RECEIVED PROPOSAL
FROM REPRESENTATIVES UNION CARBIDE FOR
HUNDRED TWENTY THOUSAND POUNDS VANA-
DIUM PENTOXID STOP WOULD YOU ARRANGE IN
ACCORD WITH SHEATH TO SECURE FIRM THAT
QUANTITY SHIPMENT OCTOBER NOVEMBER STOP
ARE NOW ARRANGING CREDIT STOP KINDLY
CABLE CONFIRMATION=

JAOL ELECTROCHIMIE=

1231P

[Stamp—Answer required—Please Ring Postal Tele-
graph]

[fol. 204]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 163

[Handwritten notation—Accounting Information 29]

Charge to the account of VANADIUM CORPORATION
OF AMERICA MOHAWK 4-3580

[Western Union Cablegram Form]

NEW YORK NOVEMBER 8, 1939

TROCHIM
PARIS

TWO ADDITIONAL LOTS PENTOXIDE PREPARED
FOR SHIPMENT STOP FIRST LOT GROSS FIFTY-
TWO SEVEN EIGHTY EIGHT NET FORTYNINE SIX
EIGHTY CONTAINED PENTOXIDE FORTYFIVE
THOUSAND VALUE FIFTYNINE THOUSAND FOUR
HUNDRED EIGHTY SEVEN DOLLARS CREDIT AC-
COUNT VANCORAM SECOND LOT GROSS FIFTY-
THREE EIGHT HUNDRED THIRTY NET FIFTYONE
FIVE HUNDRED EIGHTY FIVE CONTAINED FORTY-
FIVE THOUSAND VALUE FIFTYNINE THOUSAND
FOUR HUNDRED SIXTY FOUR DOLLARS CREDIT
ACCOUNT ELECTRO METALLURGICAL SALES COR-
PORATION STOP INCLUDES ALL CHARGES EXCEPT
WAR RISK INSURANCE STOP RECOMMEND CRED-
ITS BE ARRANGED EARLIEST POSSIBLE DATE
UNDERSTAND FREIGHT RATE INCREASE NOVEM-
BE THIRTEENTH

SEND PAID

VANCORAM

[fol. 205]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 164

[Letterhead of Vanadium Corporation of America,
New York, New York]

[Stamp—Via Air Mail]

Nov. 9, 1939

Societe d'Electro Chimie,
10 Rue du General Foy,
Paris, France.

Attention: Mr. Andre Jaoul

Gentlemen:

In connection with your cable of October 10, 1939, confirming your needs of pentoxide contained in the amount of 150,000 lbs. contained, we cabled you as follows:

Oct. 13, 1939

"Re Cable October Tenth Shipment Pentoxide Sixtyseven Steel Drums Gross Thirtyfive Thousand Four Hundred Thirtysix Pounds Net Thirtythree Thousand Five Hundred Pounds Value Forty Thousand Dollars Including All Charges Except War Risk Insurance Stop Rush Credit Guaranty Trust New York Expect Ship October Twenty-eight Steamship Independence Hall United States Lines"

Oct. 20, 1939

"Second October Shipment Three Hundred Bags Vanadium Pentoxide Gross Thirty Five Nine Ninety Five Net Thirty Four Four Ninety Five Value Exclusive War Risk Insurance Forty Thousand Dollars Letter of Credit Should Specify War Risk Insurance Covered By You Stop Open Credit Covering This Shipment to Account Electro Metallurgical Sales Corporation Stop Have Received No Advise Credit Account Vancoram per our Cable Thirteenth Im-

perative Credits be Arranged Quickly if Shipments Are to Leave October"

Nov. 8, 1939

"Two Additional Lots Pentoxide Prepared for Shipment First Lot Gross Fiftytwo Seven Eighty Eight Net Forty-nine Six Eighty Contained Pentoxide Fortyfive Thousand Value Fiftynine Thousand Four Hundred Eighty Seven Dollars Credit Account Vancoram Second Lot Gross Fifty-three Eight Hundred Thirty Net Fiftyone Five Hundred Eighty Five Contained Fortyfive Thousand Value Fiftynine Thousand Four Hundred Sixty Four Dollars Credit Account Electro Metallurgical Sales Corporation Stop Includes All Charges Except War Risk Insurance Stop Recommend Credits be Arranged Earliest Possible Date Understand Freight Rate Increase November Thirteenth"

[fol. 206] As you will note from the above cables, we now have prepared and ready for shipment in our warehouse 75,000 lbs. of contained pentoxide and Electro Metallurgical Sales Corporation have the same amount prepared and in their warehouse ready for shipment.

We were rather disappointed that the credit for the first 30,000 lot, which you advised on October 24th should be forthcoming within the week, did not come to hand and thus enable us to get this first lot off during the month of October. As we advised in the cable of November 8th, our information is that freight rates will be increased on or about November 13th. If this should take place, it will be necessary to have additional credit arranged to take care of the increased freight rate. We trust, however, that in accordance with our recommendation in our cable of November 8th, that permits and credits will be forthcoming in time for us to take advantage of the present rates in obtaining shipping space.

We would appreciate anything that may be done to rush the required credits in order to release the 150,000 lbs. of contained pentoxide which we and the Electro Metallurgical Sales Corporation have ready and jointly holding earmarked for you.

To date we have had no formal confirmation by mail from you covering your cable of October 10th.

With kindest personal regards, I am,

Yours very truly,

/s/ G

Secretary and Treasurer.

G-T

P.S. Since writing the above, credit to cover the first shipment of 30,000 lbs. contained pentoxide, in the amount of \$40,000. has been received. Shipment will go forward on the earliest possible boat.

[fol. 207]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 165

Charge to the account of VANADIUM CORP. OF
AMERICA MOHAWK 4-3580 \$15

[Western Union Cablegram Form]

NEW YORK DECEMBER 14, 1939

DEFERRED

PAINVIN
TROCHIM
PARIS

YOUR CABLE TENTH ARRANGE CREDIT COVER
FOUR HUNDRED THOUSAND POUNDS PENTOXIDE
CONTAINED AMOUNT ABOUT SIX HUNDRED
TWENTY THOUSAND DOLLARS STOP ABOUT
THREE HUNDRED TEN THOUSAND ACCOUNT
EACH ELECTRO METALLURGICAL SALES CORPO-
RATION AND VANCORAM STOP FORTYFIVE
THOUSAND POUNDS PENTOXIDE CONTAINED DUE
TO LEAVE NEWYORK DECEMBER TWENTYSIXTH
STEAMSHIP ADAMAS COMPLETING VANCORAM
PORTION FIRST ORDER

VANCORAM BRANSOME

SEND PAID

[fol. 208]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 166

Via Airmail—copy regular mail

March 28, 1940

Mr. G. J. Painvin,
Societe d'Electro-Chimie,
10, Rue du General Foy,
Paris, France.

Dear Mr. Painvin:

Your letter of February 19 finally arrived today, which is rather a record, I believe, in speedy transmission of the mails and, according to the marks on the envelope, it did not leave Paris until February 28. However, I assume these are necessary delays which none of us can complain of under the present circumstances.

I am afraid that you have misunderstood my cables and letters in respect to the situation on V_2O_5 .

At no time has the situation been easy in the supplying of either Ferro or Pentoxide. Up until the present date, we have been required, in order to keep our inventories up to a reasonable figure, to refuse to sell a great many people who have had firm orders in one hand and cash in the other and were willing to pay practically any price that we asked. As a matter of fact, for domestic consumption and what we did sell for export required us at one time to ship practically hot metal.

Our position is a little better now, but one that would speedily be uncomfortable should one large order for Ferro or Pentoxide come in from abroad or from this country.

As you probably know, we are in close touch with the Government on any Critical or Strategical materials and

have assured them that we would not sell abroad any quantities of our alloys that might jeopardize the position of our country in the event of an emergency.

In respect to some materials, the only way that we could supply them would be to have the raw materials shipped from abroad and have us process in transit, thus preserving our existing stocks of such raw materials. I can't say that I am entirely in sympathy with this procedure, but, nevertheless, it is there and must be observed.

The prices for export are still the same, namely, \$3.70 per pound for Ferro and \$1.70 for Oxide. These prices make for people trying to buy domestic and sell export, but I am happy to say that we seem to have this phase under very good control and if any shipments do get away from us they are very small ones. The good part of this program is that as long as we can control our shipments, [fol. 209] speculation by individuals is prevented and, as I said before, we are only selling to our regular domestic customers.

I am taking up your time and going into detail on this as I want you to clearly understand that it is our desire to take care of you and your requirements of any materials we have in excess of domestic requirements if you will let us know as far in advance as possible and on the same basis as our last shipments provided the export price remains the same. In short, I cannot promise that we will be in a position to ship Ferro or Oxide within a short period of time if the request comes without warning.

I feel certain that you will understand that I am not trying to build up any business for ourselves by alarming you as to the supply of Vanadium. If we had loosened up in our policy in selling certain brokers here, our supply of Vanadium would have been taken up for months to come and I think we are still in that position.

So much for business.

The news we get from your side of the water is so varied that even after a lengthy study and sifting of pseudo facts we are always in the state of bewilderment. It leaves us

only with the hope that things go well with you and that we will receive favorable news.

I hope this finds you well and that same applies to your entire family.

With my very best regards to you and Jaoul, I am

Sincerely,

/s/ E. D. B.

EDB/C

[fol. 210]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 171

VANADIUM CORPORATION OF AMERICA

INTER-OFFICE COMMUNICATION

TO D. W. Viles, Mine Supt.
Monticello, Utah

DATE May 25, 1943

FROM E. D. Bransome, President

SUBJECT PERSONAL AND CONFIDENTIAL

It occurred to me that the thing we want to do is to have our trial on the 1400 tons of roscoelite made as quickly as possible at Durango and I can not recall how long you said it would take to make delivery, that is, provided we discussed that point.

With the above objective in view, it seems to me that you might be able to arrange with Johnny Hill and Page Edwards the shipment of some of our roscoelite ore at Naturita, even though we had to absorb the trucking, inasmuch as if it is desired to move the Naturita pile, the sooner we do it the better.

If trucks are going back empty for Fall Creek and Omega, it would seem that the main expense we would be subject to would be the loading.

You probably have already thought of this, but if not, I think it might be arranged with Johnny and Page in such a manner that would not prejudice any future price that we might get from Naturita.

Will you let me hear from you as to what you think of this idea?

E. D. Bransome

IN UNITED STATES DISTRICT COURT

✓ Plaintiff's Exhibit No. 20 for Identification

INTERROGATORY NO. 33

UNION CARBIDE AND CARBON CORPORATION AND SUBSIDIARIES CONSOLIDATED

STATEMENT OF NET SALES, TOTAL COST OF NET SALES, AND PROFIT BEFORE PROVISION FOR FEDERAL INCOME AND EXCESS PROFITS TAXES PERTAINING TO VANADIUM, URANIUM, AND THEIR RESPECTIVE COMPOUNDS FOR THE PERIOD JANUARY 1, 1933 TO AND INCLUDING DECEMBER 31, 1947.

<u>YEAR</u>	<u>NET SALES</u>	<u>TOTAL COST OF NET SALES</u>	<u>PROFIT FROM NET SALES BEFORE PROVISION FOR FEDERAL INCOME AND EXCESS PROFITS TAXES</u>
1933	\$ 933,308.58	657,462.57	\$ 235,846.01
1934	1,205,401.61	923,375.70	342,025.95
1935	1,115,527.01	804,513.20	231,013.81
1936	973,068.90	732,751.95	238,316.95
1937	1,828,303.62	1,277,845.22	546,458.40
1938	1,709,554.31	944,248.46	765,305.85
1939	2,506,137.30	1,098,322.39	1,407,316.91
1940	2,532,010.30	1,198,912.96	1,333,903.40
1941	4,404,307.75	3,073,463.55	1,330,904.20
1942	4,310,810.81	3,867,253.10	443,560.65
1943	5,401,433.72	4,753,997.17	707,436.55
1944	3,876,839.95	2,893,831.09	1,002,958.86
1945	2,605,243.62	1,971,411.00	634,452.62
1946	2,270,037.07	2,444,002.20	173,975.13
1947	4,302,154.03	3,152,638.31	1,149,405.77

[Vol. 211]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 20 FOR IDENTIFICATION

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EXHIBIT IX

**YEARLY TOTAL COST (INCLUDING PROPORTION OF GENERAL
ADMINISTRATIVE AND SELLING EXPENSE) OF ALL VANADIUM
AND URANIUM PRODUCTS AND THEIR RESPECTIVE COMPOUNDS
AND TOTAL VALUE OF SALES REALIZED THEREFROM - YEARS
1933 - 1947**

<u>Year</u>	<u>Total Cost</u>	<u>Sales Value</u>
1933	\$1,389,983	\$1,235,641
1934	1,546,518	1,502,004
1935	1,348,118	1,523,689
1936	1,655,717	2,198,957
1937	2,129,574	3,157,734
1938	1,576,871	2,569,591
1939	2,951,519	4,879,016
1940	3,063,910	5,054,587
1941	4,620,155	7,680,178
1942	6,320,550	8,574,993
1943	2,443,468	3,996,464
1944	5,306,279	6,886,049
1945	3,235,019	3,992,324
1946	2,133,027	2,407,177
1947	3,850,330	4,267,850

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Form S. S. S.

CABLE ADDRESS, "FERROALLOY"
NEW YORK

G. J. EX. NO. 575

COPIES, WESTERN UNION
LIEBOWITZ A. D. C. 5TH EDITION

ELECTRO METALLURGICAL SALES CORPORATION

CARBIDE AND CARBON BUILDING, NEW YORK

DISTRIBUTORS "ELECTROMET"

FERRO-ALLOYS AND OTHER ELECTRO-METALLURGICAL PRODUCTS

SALES AGENTS

E. J. LAVINO & COMPANY, BULLITT BUILDING, PHILADELPHIA

HICKMAN, WILLIAMS & COMPANY, PITTSBURGH, CINCINNATI, CHICAGO, ST. LOUIS, DETROIT, CLEVELAND, NEW YORK, PHILADELPHIA.

MEMORANDUM OF SALE

(IN DUPLICATE)

CONTRACT NO. H-10870

September 15th, 1933

ELECTRO METALLURGICAL SALES CORPORATION A CORPORATION OF NEW YORK HEREBY AGREES TO SELL AND

Vanadium Corporation of America of New York, N. Y. HEREBY AGREES TO BUY

QUANTITY	A minimum of 1,000,000 pounds but not over a maximum of 1,250,000 pounds to be so taken.
MATERIAL	Vanadium Pentoxide (V_2O_5) - Specifications as per letter attached.
PRICE	Eighty Cents (80¢) per pound of V_2O_5 , f.o.b. cars, seller's works or warehouses, with freight charges allowed to Bridgeville, Pa., surcharge for buyer's account.
TERMS	Net cash tenth of month following date of invoice.
DELIVERY	In equal monthly quantities from date to December 31, 1934 inclusive.
REMARKS	See letter attached which is pursuant to and part of this contract.

Payments to be made in U. S. gold coin or its equivalent in currency with exchange on New York. Each delivery to constitute a separate independent contract and to be governed by the terms hereof. Works' tests of the Manufacturer of said material to govern settlements.

All agreements of the Seller herein are subject to and contingent upon strikes, riot, war, commandeering or requisitioning or allotting to others in priority to the Buyer by the Government, invasion, fire, explosion, accident, delays in procuring sufficient and suitable raw materials, curtailment or failure in obtaining sufficient electrical power, delays of carriers, and/or other delays beyond the reasonable control of the seller and/or the Manufacturer, affecting either the Seller and/or the Manufacturer of such ferro-alloy. PROVIDED, HOWEVER, that in case of and upon the happening of any such event whereby the total output of the Manufacturer's plants of ferro-alloys and/or other products which the said plants are or may be then engaged in producing, is curtailed, or a portion or all of said output is commandeered or requisitioned or allotted to others in priority to the Buyer by the Government, then the Seller shall use its best efforts to fairly and equitably pro rate any ferro-alloys, which may be produced at said plants and which are not commandeered or requisitioned or allotted to others in priority to the Buyer by the Government, between the Buyer and its other customers of ferro-alloys under contracts, on the basis of the respective minimum monthly tonnages of

[Vol. 213]

PLAINTIFF

IN 1

MATERIALVanadium Pentoxide (V_2O_5) - Specifications as per letter attached.**PRICE**Eighty Cents (80¢) per pound of V_2O_5 , f.o.b. cars, seller's works or warehouses, with freight charges allowed to Bridgeville, Pa., surcharge for buyer's account.**TERMS**

Net cash tenth of month following date of invoice.

DELIVERY

In equal monthly quantities from date to December 31, 1934 inclusive.

REMARKS

See letter attached which is pursuant to and part of this contract.

Payments to be made in U. S. gold coin or its equivalent in currency with exchange on New York. Each delivery to constitute a separate independent contract and to be governed by the terms hereof. Works' tests of the Manufacturer of said material to govern settlements.

All agreements of the Seller herein are subject to and contingent upon strikes, riot, war, commandeering or requisitioning or allotting to others in priority to the Buyer by the Government, invasion, fire, explosion, accident, delays in procuring sufficient and suitable raw materials, curtailment or failure in obtaining sufficient electrical power, delays of carriers, and/or other delays beyond the reasonable control of the seller and/or the Manufacturer, affecting either the Seller and/or the Manufacturer of such ferro-alloy. PROVIDED, HOWEVER, that in case of and upon the happening of any such event whereby the total output of the Manufacturer's plants of ferro-alloys and/or other products which the said plants are or may be then engaged in producing, is curtailed, or a portion or all of said output is commandeered or requisitioned or allotted to others in priority to the Buyer by the Government, then the Seller shall use its best efforts to fairly and equitably pro rate any ferro-alloys, which may be produced at said plants and which are not commandeered or requisitioned or allotted to others in priority to the Buyer by the Government, between the Buyer and its other customers of ferro-alloys under contracts, on the basis of the respective minimum monthly tonnages of the particular ferro-alloy to be delivered to the Buyer and to such other customers under the provisions of such contracts, but the Seller shall be released from any and all its other obligations hereunder, provided however, that any ferro-alloy sold under the agreement but not delivered to the Buyer at the times herein provided for shall be delivered by the Seller as soon thereafter as practicable, taking into consideration the requirements of such ferro-alloy of all other customers of the Seller.

No change in or addition to the terms or provisions hereof shall be made unless approved by an executive officer of the Seller in writing.

Whenever the Seller shall have any doubt about the Buyer's responsibility, it may decline to make further deliveries hereunder until the Buyer shall have satisfied the Seller of his responsibility or shall have paid for such further deliveries in advance.

If freight is allowed hereunder it is based on present existing freight rates and if such freight rates vary up or down on any shipments made hereunder the price of such shipments shall be increased or decreased as the case may be by the respective amounts of such freight increase or decrease. If any excise tax is now or hereafter imposed upon the Seller, resulting from sale or delivery under this agreement, the Buyer shall also pay the amount thereof to the Seller.

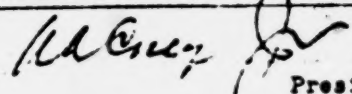
If the Buyer fails to make payments or commits any other default under the terms of this or any other contract between the parties hereto and such failure or default shall continue after notice thereof from the Seller to the Buyer, then the Seller shall have the right, at its option, without further notice, either to defer any further deliveries hereunder or to stop any shipments in transit hereunder or to cancel or terminate such contract or contracts; and no waiver by the Seller of its right to take advantage of any such failure or default shall stop the Seller to insist on its strict rights in case of and as to any subsequent failure or default.

After the Buyer has accepted same, to render this instrument binding upon Electro Metallurgical Sales Corporation, it must be approved in writing by an executive officer of said Corporation.

ACCEPTED:

VANADIUM CORPORATION OF AMERICA

BY



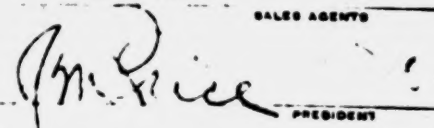
President

BY

SALES AGENTS

SALES AGENTS

APPROVED:



PRESIDENT

[Vol. 213]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT No. 25 FOR IDENTIFICATION

219

A
E. W. & S. 503METALLURGICAL SERVICE
OLIVER BUILDING, PITTSBURGH, PA.CABLE ADDRESS "FERROALLOY"
CODES: WESTERN UNION AND LIEBOWITZ**ELECTRO METALLURGICAL SALES CORPORATION**UNIT OF UNION CARBIDE  AND CARBON CORPORATION

DISTRIBUTORS "ELECTROMET" BRAND

FERRO-ALLOYS AND OTHER ELECTRO-METALLURGICAL PRODUCTS

CARBIDE AND CARBON BUILDING

30 EAST 42ND STREET

NEW YORK

September 15, 1933.

NIAGARA WORKS, NIAGARA FALLS, N. Y.
KANAWHA WORKS, GLEN FERRIS, W. VA.
VIRGINIA WORKS, HOLCOMB ROCK, VA.Mr. A. A. Corey, Jr., President,
Vanadium Corporation of America,
120 Broadway,
New York City.

Dear Mr. Corey:

This letter is pursuant to and part of the attached contract N-10870, dated September 15, 1933, calling for a minimum of 1,000,000 pounds but not over a maximum of 1,250,000 pounds of vanadium pentoxide.

This oxide will analyze from 85% to 90% V_2O_5 and the typical analysis will be the same as outlined in our letter to you of November 10, 1931, which is as follows:

Typical Analysis

V_2O_5	86.5%	S	0.40%
P	0.015%	Ni	Trace
Cu	0.015%	Na_2O	10.00%
As	Trace	Insolubles	1.00%

September 15, 1933.

Mr. A. A. Corey, Jr., President,
Vanadium Corporation of America,
11 Broadway,
New York City.

Dear Mr. Corey:

This letter is pursuant to and part of the attached contract M-10370, dated September 15, 1933, calling for a minimum of 1,000,000 pounds but not over a maximum of 1,250,000 pounds of vanadium pentoxide.

This oxide will analyze from 85% to 90% V_2O_5 and the typical analysis will be the same as outlined in our letter to you of November 10, 1931, which is as follows:

Typical Analysis

V_2O_5	86.5%	S	0.40%
P	0.015%	Ni	Trace
Cu	0.015%	Na_2O	10.00%
As	Trace	Insolubles	1.00%

Impurities are the following maximum percentages:

P	0.02%	Ni	Trace
Cu	0.02%	Na_2O	12.00%
As	Trace	Insolubles	2.50%
S	0.7%		

We agree to furnish you not over half of the total tonnage with a sulphur content of between 0.40% and 0.70% and not under one-half with a sulphur content of maximum 0.40%.

The minimum of 1,000,000 pounds is to be taken out by December 31, 1934. If the additional 250,000 pounds making up the maximum is required, the expiration date will be extended to April 1, 1935, although the buyer has the privilege of taking the maximum tonnage from date to December 31, 1934.

7,00
Dr. A. A. Corey, Jr.

-3-

64009
September 15, 1923.

It is understood that the buyer will return the bags to the seller free of charge, the seller paying the return freight charges.

The seller will furnish the buyer with analysis of each batch shipped at the time of shipment, which will be the original analysis determined at the time the material was packed.

In the event buyer's analysis of any batch differs from analysis furnished by seller, buyer will immediately notify seller and will segregate said material for further sampling. Seller will arrange with buyer to jointly sample said material and from the sample obtained one portion will be analyzed by the buyer, one by the seller and a third portion will be retained for analysis by Ledoux & Company as umpire chemist in the event buyer and seller are unable to agree on their results obtained from the joint sample.

The buyer and seller, in their respective laboratories, will analyze their portion of the joint sample, and, if the results obtained by each laboratory are in close agreement with the analysis on which the material was billed, no adjustment will be made.

In the event of a wide discrepancy in the results obtained by the respective laboratories on said sample or in the event of a dispute, Messrs. Ledoux & Company shall analyze the retained third portion, and their results shall be final and binding on both parties. The expenses of the umpire chemist will be borne by the party whose results are farthest from the results of said umpire chemist.

Thanking you to execute one copy of the contract, returning it to us and retaining one copy for your files and records, I am

Very truly yours,

G. M. Rice
President

[Oct. 21, 1923]

JMP:AP

January 24, 1934

Mr. J. M. Price, President,
Electro Metallurgical Sales Corp.,
30 East 42nd Street,
New York City.

Dear Jack:

This is to confirm our arrangement over the phone today in relation to our V_2O_5 contract with your Corporation.


While the first four cars, as I explained to you, did not develop as favorably as we expected inasmuch as we could not produce the higher quality grades, we are hopeful that future shipments along the lines suggested by your Mr. McNeill and further development work on our part will prove to be satisfactory for all grades.

As you know, we sent you our check for one-half of your original invoice for the first four cars and in early February you will receive check for the balance due.

You are authorized to ship us for receipt in early February and for March account one car of the higher grade oxide in conformity with Mr. McNeill's letter of December 27, 1933.

Immediately after running this car through our operations, I shall be pleased to communicate with you with respect to results obtained and at the same time discuss with you the question of further deliveries.

Yours very truly,


President.

Copy to P.J.G.

213

(96)

658F

16

132

November 7, 1934

Mr. J. M. Price, President,
Electro Metallurgical Sales Corporation,
30 East 42nd Street,
New York City.

Dear Mr. Price:

This will confirm my statement over the phone to you this afternoon to the effect that we will accept immediate shipment of two cars of Vanadium Oxide under the existing contract.

It will also confirm my additional statement that I would be dropping in to see you either tomorrow or Friday or early next week to discuss the balance due and other matters.

Yours very truly,



President.

[Vol. 217]

Copy to P.J.G.

U. S. LA 1101.....

ELECTRO METALLURGICAL COMPANY

30 EAST 42ND STREET

NEW YORK

F. M. HAGGERSON
PRESIDENT

November 15, 1955.

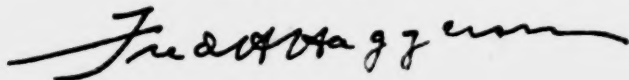


Mr. E. D. Fransore,
President, Vanadium Corporation of America,
120 Broadway,
New York, N. Y.

Dear Mr. Fransore:

I expect that we will be
getting in touch with you sometime within the
next ten days with regard to the price on Oxide.

Very truly yours,



110
METALLURGICAL SERVICE
OLIVER BUILDING, PITTSBURGH, PA.

658B
CABLE ADDRESS FERROALLOY
CODES WESTERN UNION AND LIEBOWITZ

ELECTRO METALLURGICAL SALES CORPORATION

Unit of Union Carbide and Carbon Corporation

UCC

DISTRIBUTORS "ELECTROMET" BRAND
FERRO-ALLOYS AND OTHER ELECTRO METALLURGICAL PRODUCTS

G. J. EX. NO. 725

CARBIDE AND CARBON BUILDING
30 EAST 42ND STREET, NEW YORK

November 12th, 1934.

Mr. A. A. Corey, Jr., President,
Vanadium Corporation of America,
120 Broadway,
New York, N. Y.

Dear Mr. Corey:

Confirming conversation had with you in my office on Friday of last week, please be advised that we are arranging to ship to your works between now and December 31st three additional carloads of vanadium oxide to apply against our contract N-10970, which completes the minimum of 1,000,000 pounds of oxide due on this contract. The terms to apply on these three additional carloads will be 30-60-90 days from January 1st.

We are also arranging to ship you an additional 250,000 pounds of this oxide during the months of April, May and June, 1935 with the regular terms as outlined in the contract applying and at the price stipulated in the contract. This covers the maximum quantity for which the contract was drawn but the expiration date of this contract has been extended three months.

It is the writer's understanding that, as soon as you check in this matter further, you will take up with me the question of the possibility of an additional amount which you might require for the last half of next year and we will at that time discuss the price to apply on this additional quantity.

Assuring you of our pleasure in being able to make the above changes in your present contract, I remain

Very truly yours,

J. M. Price
President

JMP:AP

WORKS LOCATED AT - NIAGARA FALLS, N. Y. - ALLOY, W. VA. - GLEN FERRIS, W. VA. - HOLCOMB ROCK

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ELECTRO METALLURGICAL SALES CORPORATION

Unit of Union Carbide and Carbon Corporation



DISTRIBUTORS "ELECTROMET" BRAND
FERRO-ALLOYS AND OTHER ELECTRO METALLURGICAL PRODUCTS

CARBIDE AND CARBON BUILDING
30 EAST 42ND STREET, NEW YORK

April 2nd, 1935.

U. S. J. EX. NO. 785

Mr. A. A. Corey, Jr., President
Vanadium Corporation of America
120 Broadway
New York, N. Y.

Dear Mr. Corey:

Pursuant to my letter of September 15, 1933 and confirming the conversation had with the writer in my office this morning, we will extend the delivery date of the 250,000 pounds of vanadium oxide still due on your contract to the third and fourth quarters of this year instead of shipment being made in the second quarter.

As arranged this morning, a car of this oxide will be shipped in each of the following months: July, September and December, 1935.

Assuring you of our pleasure in being able to make this change for you, I am, with kind regards

* Very truly yours,

[Signature]
President

April 3, 1933

Mr. E. M. Price, President,
Electro Metallurgical Sales Corporation,
30 East 42nd Street,
New York City.

Dear Mr. Price:

This morning I have your confirmation of
our verbal arrangement with respect to the remaining 250,000
pounds of vanadium oxide under our contract, dated September
15, 1933.

We appreciate your action in this matter very
much indeed.

Yours very truly,

President.

053

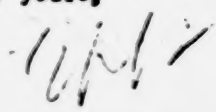
November 13, 1935

Mr. F. E. Haggerson, President,
Electro Metallurgical Company,
30 East 42nd Street,
New York, N. Y.

Dear Mr. Haggerson:

Please do not think I am hurrying you
as there is no real rush about getting a price on Oxide,
but it happened to be an item of unfinished business and
I am wondering if you have had a chance to arrive at any
conclusions as yet.

Very truly yours,



President.

101-291

ELECTRO METALLURGICAL SALES CORPORATION

CARBIDE AND CARBON BUILDING, NEW YORK

DISTRIBUTORS "ELECTROMET"

FERRO-ALLOYS AND OTHER ELECTRO-METALLURGICAL PRODUCTS

SALES AGENTS

E. J. LAVING & COMPANY, SULLITT BUILDING, PHILADELPHIA

HICKMAN, WILLIAMS & COMPANY, PITTSBURG, CINCINNATI, CHICAGO, ST. LOUIS, DETROIT, CLEVELAND, NEW YORK, PHILADELPHIA.

MEMORANDUM OF SALE

(IN DUPLICATES)

CONTRACT No. 1-10870

January 3rd 1936

ELECTRO METALLURGICAL SALES CORPORATION A CORPORATION OF NEW YORK HEREBY AGREES TO SELL AND

Vanadium Corporation of America of New York, N. Y. HEREBY AGREES TO BUY

QUANTITY

A minimum of 250,000 pounds but not over a maximum of 375,000 pounds to be so taken.

MATERIAL

"ELECTROMET" Brand Vanadium Pentoxide (V_2O_5) - Specifications as per letter attached.

PRICE

Eighty cents (80¢) per pound of V_2O_5 , f.o.b. cars at Seller's works or warehouses, with freight charges allowed to Bridgeville, Pa., surcharge for Buyer's account.

TERMS

Net cash thirty (30) days from date of invoice.

DELIVERY

As required, in as nearly equal monthly quantities from date to December 31st, 1936 inclusive.

REMARKS

See letter attached which is pursuant to and part of this contract.

Payments to be made in U. S. lawful currency with exchange on New York. Each delivery to constitute a separate independent contract and to be governed by the terms hereof. Works' tests of the Manufacturer of said material to govern settlements.

All agreements of the Seller herein are subject to and contingent upon strikes, riot, war, commandeering or requisitioning or allotting to others in priority to the Buyer by the Government, invasion, fire, explosion, accident, delays in procuring sufficient and suitable raw materials, curtailment or failure in obtaining sufficient electrical power, delays of carriers, and/or other delays beyond the reasonable control of the Seller and/or the Manufacturer, affecting either the Seller and/or the Manufacturer of such ferro-alloy, PROVIDED, HOWEVER, that in case of and upon the happening of any such event whereby the total output of the Manufacturer's plants of ferro-alloys and/or other products which the said plants are or may be then engaged in producing, is curtailed, or a portion or all of said output is commandeered or requisitioned or allotted to others in priority to the Buyer by the Government, then the Seller shall use its best efforts to fairly and equitably pro rate any ferro-alloys, which may be produced at said plants and which are not commandeered or requisitioned or allotted to others in priority to the Buyer by the Government, between the Buyer and its other customers of ferro-alloys and to deliver to the Buyer and

[fol. 224]

IN UNITED STATES DISTRICT COURT

EXCERPTS FROM PLAINTIFFS' EXHIBIT No. 47
FOR IDENTIFICATION

SPECIAL REPORT

ON

VANADIUM

C. E. MacQuigg

June 1935

[fol. 225]

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REPORT ON VANADIUM

by

C. E. MacQuigg

UNION CARBIDE AND CARBON RESEARCH
LABORATORIES, INC.

30 East 42nd Street,

New York City.

June 1935

Synopsis

The study that is the subject of this Report was made to correlate the information available on the question of vanadium production and markets in the United States today. Particular emphasis has been laid on the metallurgical uses of vanadium, and certain conclusions drawn regarding the probable trend of the future market.

The conclusion is drawn that a material reduction in selling price will be necessary to stimulate, or even to maintain, vanadium in its position as an alloying element. A tentative selling price is suggested after a review of the vanadium economics of the Electro Metallurgical Company.

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VANADIUM MARKET POSSIBILITIES

INTRODUCTION:

The ability to decide as important and complicated a question as the matter of the Corporation's policy on vanadium obviously requires a knowledge of all the facts, including the newest ones bearing on the subject. Some of

these facts have been obtained and arranged under the following headings:

I. METALLURGICAL ADVANTAGES RESPECTING THE USE OF VANADIUM

This is a subject upon which there is much information and well-defined opinion, and it is realized that we ourselves are not un-informed on the matter; however, it is worth while to re-examine the facts and opinions extant *at present*, since there is evidence that the favor with which alloys are regarded changes from time to time—somewhat like the “change of style” in other commodities. This leads to a changing emphasis which follows in part the new developments in requirements, and in part the successful sales propaganda.

II. ECONOMICS OF A “COME-BACK” FOR VANADIUM. COST OF PRODUCTION AND PROBABLE MARKET VALUE AT THE STEEL MILL

In this section, the production costs and sales prices are discussed in an attempt to determine how far a

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[fol. 229] cut in prices could be expected to go without rendering the manufacture and sale unprofitable to the Corporation. This material enables a conclusion to be drawn concerning the ability to win back the market already lost.

• III. NEW POSSIBILITIES FOR EXPANDING THE MARKET IN METALLURGY AND FOR OTHER USES IN TECHNOLOGY. CONCLUSIONS AND RECOMMENDATIONS

Markets other than the use in steel are considered for expanding the consumption of vanadium. Possibilities of different methods of utilization for metallurgical purposes are also developed. Conclusions are drawn, and recommendations made.

IV. APPENDIX. COLLATERAL INFORMATION

Data are shown respecting the economics of the vanadium situation.

ACKNOWLEDGMENTS:

The writer is indebted to Mr. Van Fleet for assistance on production costs, and to Mr. Critchett for helpful criticism.

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I. METALLURGICAL ADVANTAGES RESPECTING THE USE OF VANADIUM

It may be recalled that a survey of the automobile industry was made in 1931.¹ At that time it was learned that the unbiased views of the automobile metallurgists indicated that vanadium was on the way out, the reason being that it was too costly; other combinations, such as molybdenum steels and silico-manganese, were able to perform satisfactorily and at a considerable saving in cost to the car builder. At that time there was little or no indication that other alloy combinations were better than vanadium, but simply that they would perform satisfactorily and were much cheaper. Since the time of the survey mentioned, still further reduction in the use of vanadium has taken place, and it is hardly too much to say that its large-scale use in the automobile industry is now practically eliminated. Doubt has been expressed as to whether the preference today might still be for vanadium—even though the price differential were reduced or eliminated—and this justifies some study of whether the “style” in metallurgical thought has altered and the former real or fancied advantages of vanadium would now be admitted. These remarks apply to all types of steels utilized in the automobile, but it should be pointed out that the last stand of vanadium was in springs. The present status with respect to vanadium in the automobile is summarized by Table VIa in the Appendix, which was prepared by Mr. R. C. Good.

It will be noted that the metallurgists of the Vanadium Corporation of America stresses the beneficial effect of

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[fol. 231] vanadium on the qualities of springs; in our

¹ “Summary of the Present Status of Vanadium Steels in the Automobile Industry,” by C. E. MacQuigg and S. C. DuTot, May 11, 1931.

report¹ made in 1931, the matter of vanadium springs was carefully looked into, and at that time the situation was not particularly pleasing, nor was the outlook reassuring as to future developments. For example:

"Leaf springs: From an unsatisfactory interview at the Mather Spring Company in Toledo, it was gathered that vanadium steel was largely used for leaf springs in automobiles; however, with few exceptions it was later found that silico-manganese was used and that Mather's business must be chiefly in other lines (possibly railroad). There is also a tendency to use plain carbon steel in some of the leaves and the alloyed steel in the main leaf only. It was learned that Hupp is changing to a new steel with manganese 0.75 to 0.95% and 1.0 to 1.20% chromium. This steel was recommended by the Mather Company and is cheaper than chrome-vanadium. (We were led to believe that the steel was worked out by Timken metallurgists, as Mr. Mather is a Director of the Timken Company.) This information would lead to the conclusion that the Mather Company—who apparently were the avowed champions of the vanadium-bearing springs—were also seeking cheaper substitutes. It was learned elsewhere that the principal reasons for the Mather predilection for vanadium springs were that their shop practice and heat-treating equipment were built up around the chrome-vanadium steels.

As will be seen from the summary, Chevrolet constitutes about the only large-scale user of chrome-vanadium steel in springs. It is proving entirely satisfactory, but Mr. Spear, the Metallurgist, is looking for a cheaper steel. A pertinent portion of the detailed report on the Chevrolet interview is quoted: 'As a matter of fact, the chrome-vanadium is now out of the leaf springs in the truck, and it would have lost out in the passenger car also were it not for the fact that they might have to increase the weight of the spring slightly and since this is tied in with riding

¹ MacQuigg and DuTot, loc. cit., pages 5 and 6.

quality they hesitate to make the change; however, as soon as the spring designer can bring out a little better spring so that they can lighten its weight, they will discard chrome-vanadium.'

One car advertises chrome-vanadium leaf springs but does not use it because it costs too much!

Coiled springs: The situation with respect to coiled springs presents a number of different angles and is more involved than with the other components studied. Influences adverse to vanadium have resulted from several causes and these have combined to greatly reduce its consumption in spring wire. As estimated

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[fol. 232] by Mr. Pickwell of the Gibson Spring Company in Chicago, they are 'not making 1/20 or 1/25 of the vanadium coiled springs they made three years ago.' Briefly stated, the adverse influences are:

(a) Swedish carbon steel has been making great inroads quite recently. The Swedish interests have brought their design and manufacturing experts to this country to work with the American customers and then have striven in every way to meet the requirements of the trade. This effort has no doubt stimulated the American steel makers, with the net result that coiled spring wire (plain carbon) may be purchased with a feeling of assured quality. From two sources it was learned that the Swedish carbon spring steel also has a better surface than the chrome-vanadium. Duplicate test specimens are cut from each end of a coil of the carbon steel wire and are tested for quality by coiling, and experience has shown that this is adequate. On the other hand, the chrome-vanadium is not so uniform and the acceptance tests need to be much more comprehensive.

(b) Chrome-vanadium has not been as free from surface defects as has the carbon steel. There was a tendency to place the blame for this on the steel makers who apparently do not or cannot properly deacid their

billets. Swedish chrome-vanadium steel has better surface and is found superior to the domestic product.

(c) A further complaint against chrome-vanadium spring wire was that it is not obtainable in heat-treated condition. While the initial cost of the chrome-vanadium versus the carbon steel is about equal—in fact, it is in favor of the chrome-vanadium—the final cost is nearly two to one in favor of the carbon steel, since the latter is bought in its finished heat-treated state and needs only to be wound into the required helix and given a light tempering to remove working strains.

(d) In most cases the carbon steel has proved satisfactory, and being much cheaper it is naturally used by the spring maker when he is not tied down specifically to chrome-vanadium by the purchase specifications. In some cases as in the aircraft industry (air-cooled engines) the chrome-vanadium wire is still preferred. A few minor uses from the tonnage standpoint, as in clutch springs, still prevail.

One spring metallurgist stated that chrome-vanadium might come back if (i) the American makers would use greater care in its manufacture, and (ii) the cost were sufficiently lower to prove competitive."

The subject has not been further investigated at the present moment, but it is thought that no general increase in the consumption of vanadium in spring manufacture has taken place, nor is indicated as being about to take place.

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[fol. 233] The writings of numerous recognized authorities were consulted, and their views pro and con were abstracted to give a cross-section of what the literature contains as a result of laboratory and practical experiences:

Moore¹ found that the addition of vanadium to a plain carbon steel did not raise the endurance limit to an

¹ "Resistance of Metals to Repeated Static and Impact Stresses," R. R. Moore, A.S.T.M. Vol. 24.

appreciable degree. His vanadium steel, however, did have a high Izod value. On the other hand, the vanadium steel with a different heat treatment* had an Izod value five times that of the plain carbon steel whereas its endurance limit was less.

Oya² has studied the equilibrium diagram of the iron-vanadium system, and concludes that these metals form an *unbroken series of solid solutions*. With the addition of vanadium, the A_1 transformation is lowered; A_2 is raised, so that the two curves meet at 2.5% vanadium to form a continuous phase boundary. The A_2 point is raised gradually at first up to maximum at nearly 15% vanadium, then rapidly lowered until it reaches room temperature in an alloy containing nearly 35% vanadium. Solubility of carbon in gamma solid solution is markedly decreased by addition of vanadium. The A_1 point—that is, the eutectoid temperature—is raised 15° in the iron-iron-carbide system by the addition of 0.5% vanadium. (Vanadium operates to widen the heat treatment temperature ranges of steels.)

Losana³ states that vanadium accelerates the corrosion of steel at high temperatures in air and in internal combustion engine exhaust gases.

The mechanical properties of carbon-vanadium castings are generally superior to those of plain carbon steels, but there is little advantage in shock value.⁴ Also, it is better to normalize than to anneal.

Steels containing 0.14 and 0.30% vanadium were compared as regards tensile properties with plain structural steel, nickel-chromium and chrome-vanadium

² "Science Reports of Tohoku Imperial University," Vol. 19. See also the Transactions of the British Iron and Steel Institute, 1930, Part II, p. 626A.

³ "Corrosion of Steels at High Temperatures," L. Losana, British Iron and Steel Institute, 1931, Part II, p. 727A.

⁴ Knowlton, A.S.S.T. Transactions, September 1927, Vol. 12, p. 482.

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[fol. 234] steels.¹ Vanadium was found to raise the elastic limit and ultimate strength, and to lower the elongation, contraction, and notch toughness. Raising of the quenching temperature affects all these properties in the same direction respectively. Nickel-chromium steels are equal in strength to chrome-vanadium steels where small sections are concerned, but are superior if the section is heavy.

With the exception of the sales propaganda of the Vanadium Corporation of America, the results of laboratory tests have not always been uniformly favorable to the use of vanadium in steels. Its chief recommendations for use have been the following two: (1) The ability to widen the range of heat treatment and thus lessen the "toughness" of steels containing it, and (2) the generally accepted fact that its presence confers toughness on heavy sections of castings and forgings such as are used in railroad rolling stock. In spite of the occasionally unfavorable laboratory tests, still its good properties in the above two categories are generally accepted, and it is noted in a recent article in *THE ENGINEER* (London) which describes the "Normandie," that "because of the size and design of the (rudder) stock, vanadium steel was used in it."

While it has been axiomatic that vanadium would act as a scavenging agent as well as an alloying element in steel, it has never been seriously proposed that its efficiency as a deoxidizer justified its use for that purpose alone. Even sales propaganda literature has always pointed out that cleansing of the steel was more efficiently done by means of other elements (silicon, manganese, etc.) added first to do the major part of the "clean-up." While it

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[fol. 235] may be true that such a viewpoint arose from the high cost of the metal, still one may doubt whether vanadium can ever be sold cheaply enough to justify its

¹"Vanadium in Structural Steels," R. Hohage and A. Grützner, British Iron and Steel Institute, 1925, Part I, p. 580A. See also *Stahl und Eisen* for December 18, 1924, Vol. 44, pp. 1713-1717.

competition with the other well-established deoxidizers for such a purpose only. At any likely cost, therefore, vanadium would seem to fail as a serious competitor for the deoxidizer business as such, although it will always have that added merit.

Next consider the toughening quality of vanadium when added to steel, especially heavy castings. This is no doubt the greatest single asset from vanadium additions. In a later section, it will be shown that this is probably the greatest stronghold of vanadium today. Vanadium with chromium or nickel has a peculiar merit which cannot be successfully controverted: here again there is a rift in the lute, inasmuch as molybdenum has been gaining in favor as a toughener of steel. It is the writer's reasoned judgment that molybdenum is not as effective a toughener of high strength steel as is vanadium, but it is so nearly comparable that the approach to parity of the two classes of steels will operate to require just that much more effort to maintain vanadium as a competitor.

It is difficult to compare steels of different analyses for their intrinsic worth or usefulness. Several methods¹ have been suggested for making such comparisons; the chief difficulty results from the fact that applications differ to some extent respecting the quality of the steel considered of greatest importance. For example, a rivet steel must

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[fol. 236] be ductile, and although strength would also be desirable, ductility must come first. On the other hand, a cutting tool must be hard above other properties; nevertheless, ductility cannot be entirely sacrificed.

Some comparisons of wrought chrome-molybdenum, chrome-vanadium and chromium-nickel steel² have been made and are shown in Table I. This method makes use of a purely empirical formula which serves to arbitrarily set down a so-called "merit index." This merit index is ob-

¹ "Chrome and Nickel-Molybdenum Steels," C. N. Dawe, *IRON AGE* for March 16, 1922, Vol. 109, p. 725.

"Evaluation of the Technical Worth of A Steel from Physical Test Data," A. B. Kinzel, *A.S.M.E.* 1928.

² C. N. Dawe and A. B. Kinzel, *loc. cit.*

tained by adding together the yield point and maximum stress, multiplying that figure by one-half the elongation in 2 in., and dividing the result by 100 minus the reduction of area. In the original article the author, C. N. Dawe, shows results obtained on forged steels of the analyses noted and for different sized bars. The 2 in. square section was selected for reproduction here because it would tend to favorably accent the good obtained from vanadium respecting its toughening effect. Ductility, however, does not seem to be favorably influenced by vanadium as against molybdenum additions. This is true for all of the heat treatments noted, in which the molybdenum produced better results. (Mr. Dawe at the time of the publication of his test data was a metallurgist for the Studebaker Corporation, and it is presumed that the tests shown were the result of unprejudiced experimentation.)

Following the same method of calculation in Table II, the writer made some comparisons of the properties of *cast* steels containing different alloying elements, the tensile properties being taken from reliable sources.¹ Here again the merit indices were calculated by Dawe's formula, and

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[fol. 237] again attention is called to the fact that no particular brief is held for this type of calculation except that it does enable the visualization of all four of the mechanical properties between given steels by comparison of single figures. It may be claimed that this method is unfair in that it fails to properly accent one or more given qualities which possibly should be accented for a given application. No particular property is singled out by this method, which may be thought of as an "over-all" comparison. Zuege's remarks on the effect of vanadium on steel are as follows:

"Vanadium is a very powerful deoxidizing agent, and it is believed that the beneficial effects obtained through its use are largely due to its elimination of impurities although it also forms complex carbides. In rolled steels it is believed to produce a very fine-grained

¹ "Alloy Cast Steels," D. Zuege, Transactions of the American Foundrymen's Association, 1929, Vol. 37, p. 361.

structure. In castings it is used largely in heavy, irregularly-shaped castings in which it raises the ratio of yield point to tensile strength with no decrease in ductility.

The vanadium steels have in the past been used to a considerable extent in castings where an exceptionally clean metal was desired or where castings of intricate design were required, since vanadium does not confer marked air-hardening properties. It was believed that vanadium imparted to steels the ability to resist repeated stress to a marked degree, but some recent investigators believe that its importance in this respect has been exaggerated."

Recognizing the objections to Dawe's method of comparison, the writer has calculated the properties of two S.A.E. steels from the Society's publication just off the press.¹ Kinzel's method of calculation has been used for the results shown in the last column of Table III, the emphasis being placed on elastic ratio and ductility, and the relative

—11—

[fol. 238] weightings being given by the following exponentials:

Maximum stress	= $\frac{1}{2}$
Elastic ratio	= $\frac{2}{3}$
Elongation	= 1.0

From Table III it is seen that the vanadium steel is definitely superior. No particular justification is offered for the selection of the exponents, since they would be subject to change for different conditions of service; it is felt that they are as fair as any others for conditions where lightness must be combined with resistance to shock.

In conversation with Mr. Bob Byrd of the Midvale Company concerning the relative costs of A.A.R. steels, Classes A and B, he made the statement that the differential against Class B steel was in part due to the high manganese con-

¹ "Iron and Steel Specifications," Reprint from the 1935 S.A.E. Handbook, March 1935.

tent, which is specified somewhat higher than that of Class A and to the presence of which he quite firmly insisted the major portion of the additional physical properties were due. His personal feelings were quite "bearish" on the merits of vanadium. He further stated that vanadium was used by many steel makers for its deoxidation properties alone, so that the residual vanadium was very low—in other words, the addition of a mere pinch which might entirely disappear and certainly was not left to the extent of more than 0.03 or 0.04%.

He went still further and stated that in his own personal experience, vanadium in combination with chromium made one of the most difficult steels with which to meet specification requirements. He much prefers the chrome-molybdenum compositions. His final thought was that vanadium was due to continue its decline because of its lack of merit in comparison with molybdenum. These remarks of an experienced steel maker are included here to illustrate the

—12—

[fol. 239] widely opposing opinions that may be obtained respecting the desirability of any given steel analysis.

In Table V will be found the relative costs of a number of S.A.E. alloy steels, some of which are comparable to vanadium steel and others are not, the figures being taken from IRON AGE for April 25, 1935. It is thus seen that the most expensive vanadium steel is fourth in order of costliness of all of the steels shown, while the cheapest vanadium steel is only eighth among the eighteen steels listed, thus placing vanadium steels at present among the most expensive of alloy types.

There are more sides to the cost of vanadium steels than appear in a mere cataloging of the selling price, among them being the matter of mill losses. Due to the fact that one steel is harder to work than another, heavy rejections may be encountered because of such causes as poor ingot surface which will lead to seams and fissures, thus giving rise to excessive chipping costs. It is also a fact that some steels will cause heavy rejections from difficulties in rolling, such as corner cracking, which also is an adverse factor; the sensitiveness in heat treatment is another factor. Finally, there is the loss of the given element in re-

melting. These factors establish the selling price, and their weighted effect is expressed economically in the alloy extra except as to cost of working up by the purchaser. Table VI shows the consensus of opinion regarding some of the factors just enumerated. The showing by vanadium is about average. There are special ways of taking care of some of the difficulties mentioned, such as the remelting of the vanadium-containing scrap in an electric furnace, but this is a feature which most plants are not equipped

[Vol. 240]

TABLE VI

APPROXIMATE EFFECTS OF ALLOYING ELEMENTS ON STEEL WITH RESPECT TO MILL BEHAVIOR

Element	% Recovery When Added to Furnace.	Recovery on Re-melting.	Nature of the Combination in Steel.	Tendency to Segregate in Steel.	Effect on Ingot Yield	Effect on the Cold Steel Surface	Influence on Hot-working of Steel	Influence on Grain Size	Effect on Carburization and Penetration	Effect on Heat Treatment Qualities	Effect on Machinability	Absorbent for Nitrogen	Desulfurizer
Aluminum	None	None	(sol. solu.) None	None	Bad ⁽¹⁾	Beneficial	None ⁽¹⁾	Decreases	Good	(2)	(2)	Yes Nitralloy	Yes
Chromium	55-95 ⁽³⁾	Very low ⁽³⁾	Carbide and ferrite	Very slight	None	None	Resists	Decreases	Good	Good	Poor	Yes	Slight
Copper	94-98	Very high	Ferrite	None	None	Rather bad	Slightly bad	None	None	None	None ⁽¹⁾	None	None
Manganese	50-85 ⁽³⁾	Low ⁽³⁾	Slightly carbide	Bad	Bad	Very good	Very good	Decreases	Good	Good	Slightly bad ⁽¹⁾	Yes	Slight
Niobium	85-98	Very high	Carbide and ferrite	None	None	Bad	Resists	Decreases	Good	Very good	Very good	None	None
Nickel	93.5-97	Very high	Ferrite	None	None	Bad	Resists	None	Good	Good	Bad	None	None
Niobium O.N. Klee.	10-25 50-90 ⁽³⁾	None	Ferrite	None	Very bad ⁽¹⁾	Rather good	Resists	Increases	Bad	None ⁽¹⁾	None ⁽¹⁾	None	Yes
Phosphorus	60-95	(3)	Carbide	Very bad	Bad	None	Resists	Decreases	Good	Good	Bad	?	None
Sodium	Poor to good ⁽³⁾	Poor ⁽³⁾	Carbide and ferrite	None	Bad	Fair to None	Rather poor	Decreases	Very good	Very good	None	Yes	Yes

(1) To be accepted with modifications.

(2) Secondary (grain size primary).

(3) Depends on slag condition.

NOTE: Some data from "Basic Open Hearth Practice," A. N. Diehl, American Iron & Steel Institute 1926.

[fol. 241] to make use of on a tonnage basis. It is not therefore likely that any return scrap value can be credited to vanadium.

Another aspect of the metallurgical use of vanadium which has already been mentioned, needs to be considered in more detail; namely, the scavenging effect it has on steels. This use, while it has long been recognized, has not been emphasized commercially, chiefly because of the high cost of vanadium. However, this picture might possibly be changed; if the cost of vanadium could be brought down materially, it might conceivably allow the element to be "built up" in popularity as a scavenging agent. This angle to the vanadium question is involved with the ability of that element to refine the grain of steel. Grain refinement is an objective of the steel manufacturer, since in general the fine-grained steels are characterized by greater toughness. Recent researches into the relationship of the history of the heat (deoxidation) and grain size in the resulting steel have shown that the fineness of grain can be controlled by manufacturing technique, and that even aluminum can be made to bring about the desired results. In the words of a well-informed metallurgist of our own organization, "So much information has recently been acquired respecting the effect of deoxidation on grain size and how to control it by the use of the cheaper aluminum, it is doubtful if vanadium can be kept in its former place as a grain-refining addition to steel." Such views are disturbing enough to warrant some careful study of the facts. What has been found out concerning aluminum is briefly stated herein, but unfortunately nothing like the same kind of information is available on specific scavenging action of vanadium.

[fol. 242] In brief, the theory is that a melt of steel on freezing will form a fine-grained mass if enough critically dispersed nuclei are present in the form of non-metallic inclusions; in the absence of such nuclei in critical dispersion, the mass of steel may be coarse-grained. In this way a very clean steel might be coarse-grained, as also would be a steel with (say) very coarsely distributed non-metallic

particles (i.e., supercritical dispersion). Herty¹ has recently published his conclusions on this matter, which in part are as follows:

"The grain size of plain carbon steels is profoundly affected by the method of deoxidation used.

In mild steels, 0.15 to 0.25% carbon, the finest-grained steels are those to which an excess of aluminum has been added for deoxidation. Semi-killed steels to which a small amount of aluminum has been added are fairly fine-grained in the normalized condition, and silicon-killed steels are more coarse-grained than the semi-killed steels. Both semi-killed and silicon-killed steels are very coarse-grained when heated to 1000° C. (1832° F.) for 1 hr. Steels with excess aluminum are still fine-grained after this treatment, but become coarse-grained at about 1100° C. (2012° F.).

Ladle additions of aluminum, amounting to 0.03% give a very fine-grained steel. If the aluminum is added in the furnace, either as a complex deoxidizer or as ferro-aluminum, the resultant grain size of the steel is very similar to that of a silicon-killed steel. It is evident that under these conditions the alumina particle has been fluxed, thus destroying its ability to act as a nucleus for crystallization."

Whether or not one can agree with the views expressed above, it must be admitted that *any* advancement of technique involving a cheap and effective grain control by means of proper deoxidation of the steel bath is distinctly

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[fol. 243] detrimental to the commercialization of the costlier vanadium. If the grain-refining action of vanadium be due to its deoxidizing power, then by the same token any other efficient deoxidizer would be as effective. It is not

¹"Effect of Deoxidation on Grain Size and Grain Growth in Plain Carbon Steel," C. H. Herty, D. L. McBride and S. O. Hough, Cooperative Bulletin #65 of the Mining and Metallurgical Advisory Board.

argued that aluminum is as good as vanadium, but on the other hand we must admit that arguments are already available that such is the case. As a matter of fact, vanadium has a dual role; namely, partly as a true alloying element and partly as a scavenger, and this certainly cannot be said about aluminum. To that extent vanadium must always enjoy an advantage, but this is not great enough at the present cost of vanadium.

When, as, and if the cost of vanadium is reduced to a semi-competitive basis as a *deoxidizer*, then we shall doubtless have certain arguments in favor of its use, and these may be developed out of research programs. As an instance, the use of vanadium in a silicon alloy is mentioned, on the assumption that such a combination would give simultaneous reduction and alloying actions; in other words, the silicon will do the rough work of deoxidation, and the vanadium will exert its effect as a strengthening element. This might or might not work advantageously, depending on the correctness of Herty's explanation of the mechanism of grain size control. We might go further and show by experiment that vanadium has afforded an ideal grain size control mechanism because of its simultaneous scavenging and true alloying behaviors. Going a step still further, at a competitive price for vanadium, research might show that alloy steels treated with vanadium are feasible for certain railroad applications where they are now excluded because of their poor showing. Thus a simple dosage with vanadium in such quantities as to allow for partial loss through oxidation but still finishing with enough to permit residual alloying effect might result in a new kind of alloy

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[fol. 244] steel—perhaps, an "Izett" type of alloy steel. At present there is a considerable total quantity of vanadium accounted for by additions to many different types of alloy steels, but in such small amounts as to be residual in not more than 0.01 to 0.05%. Even in such small amounts, many metallurgists contend that the addition is markedly beneficial and that they will not abandon the practice.

In view of the fact that these new ideas respecting the grain size control of steels through the proper use of deoxidizers has been to a large extent based on data re-

cently published in this country, it is of interest to note the views of a British metallurgist,¹ in part as follows:

"One of the most outstanding metallurgical developments of recent years is the gradual accumulation of knowledge that has led to appreciation of the importance of "inherent austenite grain size," and to some understanding of the methods by which it can be controlled. From the same heat it is possible to produce either inherently coarse-grained or inherently fine-grained steel by controlling the aluminum additions. In the coarse-grained austenite, grain growth takes place at lower temperatures than in the fine-grained. This affects the behavior of the steel in heat-treating operations and has a pronounced influence on the properties obtained. For some purposes coarse-grained steel is preferred, but in general the fine-grained type is best. If, however, the two types are not distinguished and steel of a given analysis turns out to be coarse-grained or fine-grained simply as a matter of chance, then as a result of variations in the behavior of different heats difficulty will be experienced in forging, heat treating and machining under mass production conditions. Furthermore, the mechanical properties obtained in the finished product will vary from heat to heat.

The production of inherently coarse- or fine-grained steel depends primarily on the amount of aluminum added before casting, but control of the manganese,

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[fol. 245] and silicon additions is also important, and titanium when added with the aluminum tends to increase the cleanness and uniformity of the steel.

Besides aluminum, other strong deoxidizers like titanium, zirconium, and vanadium are known to cause fine grain, but somewhat larger additions are required

¹ "Grain Size Control and Its Effect on the Mechanical Properties of Forgings," J. M. Robertson, METAL TREATMENT, Spring Number 1935, p. 21.

than in the case of aluminum, and the elements are considerably more expensive. The question to be investigated is whether titanium and zirconium give results sufficiently, if any, better than aluminum to justify the greater cost."

Dr. Robertson barely mentions vanadium, no doubt because of its present cost. With regard to the effect of the additions of aluminum on ingot surface and cleanliness of the steel, Robertson is quoted further:

"The amount of aluminum and silicon required to give inherently fine-grained steel results in fully-killed deeply piping ingots, and for economical manufacture molds with feeder heads must be used. The surface condition of ingots does not lend itself to quantitative study, but according to Epstein, Nead and Washburn, such data as could be obtained did not indicate that either ladle or mold additions of aluminum adversely affected the surface. The same investigators also studied the cleanness of experimental heats of fine- and coarse-grained steel by microscopic inclusion counts and oxygen determinations by the electrolytic extraction method. Satisfactory agreement between the two methods was obtained, and as a result of the work it was concluded that the moderate ladle additions of aluminum required to produce fine-grained steel did not increase the number of detrimental inclusions. Even mold additions up to 12 oz. per ton did not decrease the cleanness of the steel."

With regard to the item of cost, aluminum would cost only 20½¢ per ton when added in 16 oz. dosages per ton of steel, at the current price of that metal. This matter of deoxidation is mentioned here in some detail because it is quite plain that it has a most important bearing on the question of grain size control, which in turn is itself bound up with the benefits of vanadium treatment. If in due time the metallurgist becomes convinced that his results may be obtained by means of additions of cheap aluminum as

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[fol. 246] against a more expensive alloying element such as vanadium, then it will become just so much more difficult to sell the vanadium. It will always be possible to embark on a campaign of counter-propaganda, decrying if possible the use of aluminum because of certain objectionable features, but the fact still remains that ultimately the steel maker will pay no more for his materials than he must in order to obtain the necessary results.

There is one field in which vanadium so far has held undisputed pre-eminence—namely, as an addition to high speed steels. The importance of the position of vanadium in high speed steel is best illustrated by the remarks of the late Dr. J. A. Mathews,¹ who was an authority on the subject.

"In 1903 the writer experimented with the addition of vanadium to high speed steel and brought about a considerable improvement. The efficiency was increased from two to three times. This resulted in the steel known as Rex AA, which is now the standard type known as 18-4-1, meaning 18% tungsten, 4% chromium and 1% vanadium. That steel has remained as a type for over 25 yr., and for general all-around purposes has not been improved upon."

Vanadium seems to have held its own in the high speed steels in spite of its costliness, and there is no reason at this moment to suspect that its position is being threatened. It might, therefore, be argued that a considerable portion of our vanadium market has been maintained in face of high prices and that to cut the price now when this market is not threatened is to show poor business judgment. More

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[fol. 247] of this discussion is included in a later section, but in connection with the last thought it must always be remembered that high costs invite research for substitutes which might be discovered and might destroy the present

¹ "The Electric Furnace and the Alloy Age," John A. Mathews, Transactions of the Electrochemical Society, Vol. LXI, 1932, p. 139.

market. (This has actually happened with the molybdenum high speed steels, where the urge has been a strategic one.) As against the possibility of the development of substitutes for vanadium in the high speed steels, it can be pointed out that the trend is apparently in the opposite direction at this time. Several patents have recently been issued to J. V. Emmons of the Cleveland Twist Drill Company and to others, covering new compositions in what are purported to be more efficient high speed steels. These compositions contain from 2 to 6% vanadium, and in the event that the steels prove up to expectations an increased market for vanadium is promised. The vanadium content of the average high speed steel, as shown by a study of some fifty analyses of representative American and foreign steels, is from 0.6 to 1% or more.

Summing up the information on steels, one may conclude that there are several different types of steel employing one or more of the elements chromium, nickel, molybdenum, manganese, silicon or vanadium, and that there is little choice between them with respect to mechanical properties for most common applications. One may manipulate the calculation of the "merit" or "worth" of various steels, but after all the deciding factor governing the selection of a steel will quite largely depend on certain other conditions, such as prejudice of the metallurgist writing the specifications, ease of machinability, "foolproofness" in heat treating, special requirements such as stainlessness, and finally, but not the least important of all, the unit cost.

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[fol. 248] From the figures assembled in this section it is clear that the balance is quite close between any one of several different analyses; this has also been shown in the literature.¹ One may therefore conclude that the decline in the tonnage of vanadium steels has been due mostly

¹ "The Relative Merits of Some Different Alloy Steels with Respect to Certain Mechanical Properties," Bradley Stoughton and W. E. Harvey, *Proceedings of A.S.T.M.* 1930, Part II, p. 241. (This article shows "merit" calculations on a number of steels by several different methods. It is interesting that the authors give a high rating to the chrome-vanadium steels.)

to a competitive situation and less to the improvement in properties over other analyses. By the same token it should be possible to revive a considerable tonnage of the vanadium steels, either of the standardized analyses or any types growing out of our research efforts, by a substantial lowering of the cost of vanadium.* Discussion of the feasibility of such a cut in selling price is deferred to a later section of this report.

Use of Vanadium in Cast Iron: Not a great deal of information is available on the effect of vanadium in cast iron, since such use has not been commercialized because of cost considerations. Rather more research seems to have been done in England than in America. A number of references have been studied, and the definite conclusions justified that vanadium is beneficial in its effects on cast iron. It belongs to the hardening, strengthening, carbide-forming group rather than with the softening, graphitizing group—that is, it belongs with chromium rather than with silicon in its chief effects but with this difference: It is somewhat milder in action. Vanadium gives a denser,

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[fol. 249] stronger, finer-grained casting which has particular merit for certain applications. From one of the most comprehensive researches consulted,¹ the following conclusions were drawn:

"Type	% C	% Si	% Mn	% P	% S
A	3.55	1.46	0.42	0.077	0.022
B	3.7	2.7	0.56	0.11	0.04
C	2.5	2.5	0.55	0.07	0.038

The strength in compression of Alloy A was raised 40% by 0.5% vanadium, 10% by 2% nickel, and about 40% by the combined addition. In B the effects were less marked, but in C the compressive strength was increased about 30%. The bend strength of A was

* See Appendix for further opinions quoted on this subject.

¹ "Influence of Nickel and Vanadium on the Properties of Cast Iron." IRON AGE for March 26, 1931, p. 1028, which is an abstract of an article by J. Shallansonnet (Revue de Metallurgie, November 1930).

increased 30%, B 50%, and C 30%. Vanadium addition produced about 50% better resistance to shear, though the influence was less on B. Nickel diminished the effect of vanadium. Alloys of Type C containing vanadium with and without nickel, varied in hardness from 500 to 350 Brinell."

J. E. Hurst,¹ one of the leading British investigators, has done considerable work with vanadium in cast iron, and his conclusions are summarized as follows:

"As a result of tests made by one of the U.S.A. railroads, locomotive cylinders containing vanadium showed only microscopical wear after 200,000 miles running. Cylinders without vanadium additions showed appreciable wear—about 1/32% after 100,000 miles of service. Similar results have been reported in the case of large cylinders and liners in internal combustion engines.

Amount of Vanadium and Its Addition to Cast Iron:

For ordinary purposes the amount of vanadium recommended to be added to cast iron is about 0.15%. It is generally recommended that the additions should be made by way of ferrovanadium to the molten metal

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[fol. 250] in the ladle. The ferrovanadium should preferably be ground to powder, in which form it can be conveniently added to the molten metal as it flows down the cupola spout. Pig irons are now available containing at least 0.50% vanadium, together with an approximately similar percentage of titanium. These pig irons offer a very convenient and cheaper method of obtaining vanadium in the castings. They can be used direct in the cupola without loss of vanadium. It is found that the titanium present prevents the loss of vanadium, itself undergoing a loss of about 20%."

In view of what is already definitely known regarding the effect of vanadium in cast iron, plus what can be rea-

¹ "Vanadium and Titanium in Cast Iron," Foundry Trade Journal, September 5, 1929, p. 173.

sonably predicted in the way of beneficial effects, it is believed that probably a considerable market can be worked up, especially in the light of the increasing popularity of "high test" cast irons. That vanadium has not been used heretofore does not seem to be so much a metallurgical question as a commercial one. Quite an opposite to the above views has been gathered from consultation with one of our metallurgical staff, who feels certain that equal results may be obtained much more cheaply by other alloy additions to cast iron: e.g., a balance of chromium and silicon.*

Use of Vanadium in Non-Ferrous Alloys: The use of vanadium in non-ferrous alloys is not a new idea, since there is extensive patent literature covering its addition to the copper-base, the aluminum-base, and to a lesser extent to the zinc-base alloys respectively. In general, the effects are similar to that of titanium in the copper-base alloys.

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[fol. 251] and a considerable tonnage of vanadium bronzes is sold. Here again, it might be confidently expected that price revisions would stimulate expansion of consumption. It is also obvious that new combinations replacing ferro-vanadium would need to be developed because of the undesirability of iron as a constituent of many of the non-ferrous alloys.

For reasons already pointed out, it is not possible to make a very definite monetary comparison between the relative values of two or more different steels because of their diverse qualities. Moreover, no matter how specific the comparison might be made, it would still be unconvincing to the metallurgist who might be prejudiced against the given steel; he would always be able to adduce arguments why he could not accept the conclusions, provided they were against his favorite steel. In spite of these handicaps, it is worth while to make some comparisons suggested in Table III, where a chrome-vanadium steel has been contrasted with one of its closest competitors—namely, chrome-molybdenum.

* See Appendix for further views on this subject.

The selling price of chrome-molybdenum (Series ± 4100) is 2.95¢ per lb. and for the chrome-vanadium (Series ± 6100) it is 3.65¢ per lb., or a differential of 0.70¢ per lb. against the vanadium—since the chromium content is the same in both steels. Deducting the base rate of 2.45¢ for all S.A.E. steels of these types, it is seen that the cost of vanadium must be made to shrink from $3.65 - 2.45 = 1.20$ ¢, to 0.70¢, or a devaluation of $\frac{1.20 - 0.70}{1.20} \times 100 = 41.5\%$.

Since the grade used is what we market as "open hearth" which sells at \$2.70 per lb. of contained vanadium, the

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[fol. 252] selling price of vanadium will have to be about $\$2.70 \times (100 - 41.5\%) = \1.58 per lb. to make it compete on an equal cost basis with molybdenum. It should be noted that this comparison is on a dollar-and-cents basis only, and that it disregards the arguments which might be advanced to the steel maker as to why he should use vanadium in his steel practice; enough has been shown to indicate that such arguments would always be weighed in the light of prejudice for or against.

We must again bring to notice the fact that a mere cataloging of the tensile qualities of a number of different steels is alone not sufficient to make a sale on the one with the most attractive characteristics as shown by laboratory tests. Many other factors are known to contribute to the popularity of a steel, as explained below:

"The selection of the proper steel to be used in various parts of an aircraft engine involves more than the mere writing of an S.A.E. number on the drawing. Behind the selection of a steel for a particular purpose there are a number of considerations to be taken into account. These not only relate to the performance of the steel, but also to the methods of preparation which are necessary to put it into the proper condition to perform the functions demanded of it. The performance of steels is generally based on such properties as elastic limit, strength, hardness, ductility, fatigue, wearing quality, etc. However, these properties are only a few of those that contribute to the successful application

of metals. Due consideration must also be given to such factors as uniformity, depth of hardening, tendency to warp, hardening range, forgeability, machinability, etc. All of these properties are inherent in the alloy and contribute to its success or failure in performing the functions for which it is intended."

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[fol. 253] This feature of multi-sidedness in steel popularities has been set down here in more detail than might seem justified because it makes a point which will be brought up later—namely, that considerable effort will surely be required to "put across" vanadium even though the cost to the consumer is greatly lowered. Sales development propaganda based on the results of laboratory disclosures will most certainly have to be actively fostered. Among the possibilities are: Better heat treatment response from the vanadium-containing steels; better rolling qualities; better ingot surface, with attendant advantages to shipping costs; less cracking in rolling or forging; better mechanical properties, particularly in heavy sections, especially castings; cleaner steels; and others which might be mentioned. Some of the foregoing are known to be among the advantages occurring because of the presence of vanadium, while others are at best doubtful; the answers could be obtained by laboratory and plant experimentation.

Recognizing the fact that carbon-vanadium steel castings are widely used for heavy sections in the railroad field, some data are included on the mechanical properties of such steels. It can be assumed that the qualities particularly desired in this latter application are high strength with high elastic ratio (permitting reduction in design weight), together with toughness and resistance to shock. How these results have been obtained by the various analyses may be seen in Table IV, where it is evident that the nickel steel is more ductile but less strong than the vanadium steel, while both are superior to the plain carbon steel in strength

¹ "Quality Factors," Messrs. Gillett and Moore, Metals & Alloys, November 1930, p. 811.

as well as ductility. It is interesting to note that the relative

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[fol. 254] costs of the two steels are as follows:*

Grade of Steel	\$ per Gross Ton	c per Lb.
Plain carbon, or Class A	32.00	1.428
Carbon-vanadium, or Class B	70.00	3.125

It is thus apparent that between the two steels, A and B, which are in competition in the railroad field, there exists a differential of about 1.7c per lb. against the vanadium steel. In spite of this additional cost, there is an unknown tonnage of Class B steel sold; the present tonnage would almost certainly be increased by a lowering of the price of vanadium.

From the foregoing it may be concluded that at the price now being charged for vanadium, its use in steel is not likely to increase, and it seems reasonable that it will almost surely continue to decline for some applications. Also, it is apparent that the decline that has already come from the substitutions of other steels is not due to the lack of merit of the vanadium steels, but rather to the fact that the vanadium steels are so near parity with competing compositions that no preference is justified from an economic standpoint. By reason of this equality, it should be possible to greatly help vanadium sales by a cut in selling price.

* Personal communication from The Midvale Company.

Analyses of the Given Steels -- 1

	Cr-Mn	Cr-V	Cr	Cr-Ni
Carbon	0.260	0.520	0.510	0.250
Manganese	0.570	0.750	0.850	0.720
Sulphur	0.020	0.033	0.01	0.012
Phosphorus	0.025	0.025	0.020	0.020
Chromium	0.800	1.030	0.910	0.500
Molybdenum	0.350	—	—	—
Vanadium	—	0.160	—	—
Nickel	—	—	—	1.270

Results on Tensile Tests on Above
1/2 In. Square Sections

Grade of Steel	Quench ° F.	Draw ° F.	Lb./Sq. In.		%	%	Morit
			Yield Point	Maximum Strength	Elong.	R.A.	
Cr-Mn	1550-1600	1000	100500	125100	27.6	62.0	85.0
Cr-V	1550-1600	1000	104400	119500	24.2	61.5	70.3
Cr	1550-1600	1000	98575	118000	20.7	61.3	55.4
Cr-Ni	1475-1575	1000	96200	119600	19.9	62.5	57.9
Cr-Mn	1550-1600	1100	100500	117200	25.4	66.2	82.6
Cr-V	1550-1600	1100	112000	127000	24.3	59.0	71.3
Cr	1550-1600	1100	85750	105700	21.8	65.0	59.0
Cr-Ni	1475-1575	1100	89375	111550	21.8	65.0	62.5
Cr-Mn	1550-1600	1200	70300	100600	29.0	70.0	86.7
Cr-V	1550-1600	1200	107000	120000	23.4	59.0	65.1
Cr	1550-1600	1200	77875	99575	24.2	60.5	68.1
Cr-Ni	1475-1575	1200	78750	102900	25.3	68.7	73.4

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TABLE IIMECHANICAL PROPERTIES OF SOME ALLOY CAST STEELS

Heat No.								Heat Treatment		Mechanical Properties							Merit Index
	%C	%Mn	%Si	%Cr	%Ni	%Mo	%V	Quench °F	Draw °F	Lb./Sq.In.		% Elong. 2 in.	R.A.	Brinell	Charpy		
										Yield Point	Maximum Strength						
000	0.52	1.34	0.43	-	-	-	-	1650 Air	-	64250	110200	22.5	47.8	223	15.1	37.6	
000A	0.52	1.34	0.43	-	-	-	-	" " 1250 Air	-	50250	93250	24.0	54.4	202	14.5	33.4	
*7-3	0.53	0.83	0.40	0.80	-	-	-	" " " "	-	53600	93400	18.5	26.0	217	-	13.4	
*3-3	0.53	0.84	0.43	0.79	-	-	-	(1650 Air) 1200 " (1550 ")	" "	67150	110350	17.0	25.0	217	-	22.5	
3-3	0.47	0.74	0.63	0.93	1.44	-	-	Ditto	Ditto	60250	117050	18.0	43.0	241	-	32.6	
00-10	0.54	1.53	0.40	0.71	1.22	0.32	-	1650 Air	1000 Air	145750	177000	13.5	35.0	307	9.2	33.5	
***	0.53	0.77	0.52	-	-	-	0.18	Norm.	-	52300	83700	26.0	46.7	162	-	34.9	

TABLE IIICOMPARISON OF CR-VA WITH CR-MO STEEL TO ACCENT TOUGHNESS PROPERTIES

COMPARISON OF CR-VA WITH CR-MN STEEL TO ACCENT TOUGHNESS PROPERTIES														El.			
														Ratio	Worth		
**4140	0.40	0.75	-	0.95	-	-	0.18	(Norm. 1700	900	140000	160000	13.0	47.0	293	87.50	36.8	103.33
**4140	0.40	0.75	-	0.95	-	0.20	-	011 1600)	900	146000	170000	11.0	40.0	352	85.9	43.6	63.30

* 7-3 refers to Zuege's steel #7 in Table 5; 3-3 to steel 3 in Table 6, etc.

** SAC specifications and properties are given as types.

*** Private communication from the New York Central Railroad.

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TABLE IV
ASSOCIATION OF AMERICAN RAILROADS
SPECIFICATION FOR NORMALIZED AND TEMPERED
STEEL FORGINGS

*Chemical Analysis**

Class	% C	% Mn	Max. % P	Max. % S	Min. % Si	Min. % V	% Ni
A	0.40-0.55	0.60-0.90	0.045	0.05	0.15	—	—
B	0.40-0.55	0.70-0.95	0.045	0.05	0.15	0.15	—
C	0.20-0.27	0.75-0.95	0.045	0.05	0.15-0.35	—	2.50-3.00

* In Classes A and B, the chromium and nickel may not exceed 0.15% and 0.25% respectively. In Class C, the chromium may not exceed 0.15%.

Minimum Tensile Properties

Size Outside Diameter or Over All Thickness	Lb./Sq. In.		% Elongation—2 In.		% Reduction of Area	
	Yield Point	Tensile Strength	Inverse Ratio	Not Under	Inverse Ratio	Not Under
Class A						
Not over 8 in., 4 in. max. wall	50000	88000	2,500,000 ten. str.	25	3,650,000 ten. str.	40
Over 8 to 12 in., 6 in. max. wall	48000	86000	2,100,000 ten. str.	24	3,320,000 ten. str.	38
Over 12 to 20 in., 10 in. max. wall	46000	84000	2,000,000 ten. str.	23	3,100,000 ten. str.	36

Class B

Under 5 in.	60000	90000	—	24	—	48
5 to 9 in.	60000	90000	—	22	—	44
9 to 13 in.	58000	90000	—	21	—	42

Class C

Under 8 in.	55000	80000	—	28	—	60
8 in. and over	55000	80000	—	28	—	55

Note: Additional specifications are given for grain size, and Steel B shows a much finer grain than Steel A.

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RELATIVE PRICES OF ALLOY STEELS*

Note: The open hearth grade base price is \$2.45 per pound. The differential for alloy content of the given analysis is shown in Column A and the total or combined cost in Column B. Column C shows the relative order of cost.

SAE No.	Name	ANALYSIS							A	B	C
		% C	% Si	% Cr	% Mn	% Ni	% Mo	% V	¢/lb.	¢/lb.	
2000	0.5 Nickel	-	0.15-0.30	-	0.30-0.60	0.40-0.60	-	-	0.25	2.70	14
2100	2.5 "	-	"	-	"	1.25-1.75	-	-	.55	3.00	10
2300	3.5 "	-	"	-	0.50-0.80	3.25-3.75	-	-	1.50	3.95	4
2300	5 "	-	"	-	0.30-0.60	4.75-5.25	-	-	2.25	4.70	3
3100	Nickel-Chromium	-	"	0.45-0.75	0.30-0.60	1.00-1.50	-	-	.55	3.00	10
3200	"	-	"	0.90-1.25	0.30-0.60	1.50-2.00	-	-	1.35	3.80	5
3300	"	-	"	1.25-1.75	0.30-0.60	3.25-3.75	-	-	3.80	6.25	1
3400	"	-	"	0.60-0.95	0.30-0.60	2.75-3.25	-	-	3.20	5.65	2
4100	Chromo-Molybdenum (0.15-0.25 Mo)	-	"	0.60-1.10	0.60-0.90	-	0.15-0.25	-	.50	2.95	11
4100	Chromo-Molybdenum (0.25-0.40 Mo)	-	"	0.60-1.10	0.60-0.90	-	0.25-0.40	-	.70	3.15	9
4400	Nickel-Molybdenum (0.20-0.30 Mo, 1.50-0.20 Ni)	-	"	-	0.40-0.70	1.65-2.00	0.20-0.30	-	1.05	3.50	7
5100	Chromium (0.60-0.90 Cr)	-	"	0.60-0.90	0.30-0.90	-	-	-	.35	2.80	13
5100	Chromium (0.80-1.10 Cr)	-	"	0.60-1.10	"	-	-	-	.45	2.90	12
5100	Chromium Spring	-	"	-	-	-	-	-	Base	2.45	15
6100	Chromo-Vanadium Bar	-	"	0.80-1.10	0.30-0.90	-	-	0.15	1.20	3.65	6
6100	Chromo-Vanadium Spring	-	-	-	-	-	-	-	.70	3.15	9
	Chromo-Nickel-Vanadium	-	-	-	-	-	-	-	1.50	3.95	4
	Carbon-Vanadium	-	-	-	-	-	-	-	.95	3.40	8

Note: The above prices are for hot-rolled steel bars. The usual differential for electric furnace steel is \$0.30 higher per 100 lb. The above table is based on the price for bars which are classified as all sizes under 4½ in. or equivalent. Slabs with a sectional area of 16 sq. in. and 2-1/2 in. thick or over are considered as billets which have a base price of \$48 per gross ton, or \$2.19 per 100 lb. Sections 4½ in. to 10x10 in. or equivalent carry a gross ton price which is the net price for bars for the same analysis. Larger sizes carry extras.

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II. ECONOMICS OF A "COME-BACK" FOR VANADIUM. COST OF PRODUCTION AND PROBABLE MARKET VALUE AT THE STEEL MILL

Some general information respecting the economic phases of vanadium consumption in this country has a bearing on the subject of this report because this information will be helpful in reaching a conclusion as to policy questions. In general, a certain step which might be considered to involve some hazard might be followed if there were an assurance of very large possible gains, whereas the same step might not be taken were it shown that the most optimistic outcome as to the final monetary returns would not warrant disturbing other economic factors.

Fig. 1 charts the tonnage statistics of vanadium in the United States since 1914, as plotted by Mr. Judd of our Mining Department, from "Mineral Resources" and elsewhere. As previously noted, the World War and the Business Depression have introduced such vagaries that it is impossible to draw conclusions as to stabilized trends of consumption. The disturbances to normal business have further been augmented in effect as regards vanadium by the substitution of other and cheaper alloying elements, and it may indeed be questioned as to whether or not this latter encroachment has not been allowed to get out of control at this late date. Similar data have also been plotted by Mr. Judd for molybdenum over the same period (Fig. 2).

Statistics on the production of ore or even contained vanadium do not clearly show the amount of vanadium actually consumed by the whole country. At times, certain amounts of vanadium have been bought in the market and held for later sales; at other times, vanadium has been

[fol. 260] produced above requirements and stored as oxide against future sales. Since we are not the only producers, nor have we heretofore been the chief ones, it is not accurate to base total consumption of past years on our own sales. Due to a change in conditions however, our chief

competitor and formerly the principal producer, has come to us, it is understood, for a very considerable portion of his oxide; what proportion this was in 1934 and since, the writer has not learned. From conversation with those best informed in our own company, this figure has been taken at about 7/10 of his requirements. For 1934, this would give us a close estimate of the business when equated to pounds of contained vanadium.

In answer to some specific inquiries, Mr. Judd has furnished his opinions based on studies of the statistics, and these are condensed as follows:

- 1—Heretofore the imports have supplied about 60% and domestic production about 40% of this country's vanadium requirements.
- 2—It will be noted from Fig. 1 that imports ceased in 1931 and resumed momentarily in 1934. This 1934 importation was a small lot of Peruvian ore, and it is thought that the Minaes Ragra district is out as an active source of supply.
- 3—It is believed that at present between 90 and 95% of the vanadium consumed in America goes into steel.
- 4—It is believed that for the seven years ending with 1933, the U. S. Vanadium Corporation sold about 25% of the ferrovanadium used in this country.

Some useful information can be obtained from Table VII which was arranged from data supplied by Mr. C. O. Jacoby and from other sources, and most of it is probably quite accurate; even where unsupported by figures, the

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[fol. 261] assumptions are probably close enough to serve adequately for present purposes.

TABLE VII

Sales by
U. S. Vanadium Corp. and Electro-Metallurgical Co.,
By Years and Grades

Year	High Speed		Open Hearth		Special		Total
	Lb.	% Total	Lb.	% Total	Lb.	% Total	
1927	61,128	37.3	45,329	27.5	57,414	35.0	163,871
1928	90,039	18.3	312,874	63.4	89,519	18.2	492,432
1929	13,540	3.93	165,400	47.9	166,283	48.1	345,223
1930	3,772	2.57	79,641	54.2	63,944	43.5	147,357
1931	469	.3	101,580	64.8	56,205	35.4	158,254
1932	563	.9	43,578	66.5	21,606	32.8	65,747
1933	1,402	.5	208,930	76.6	61,897	22.8	272,229
1934	3,034	1.4	189,875*	67.5	24,722	11.3	217,631*
	173,947		1,147,207		541,590		1,862,744

* Includes 28,409 lb. of vanadium in Open Hearth Grade not of our own manufacture.

*) Note: Percentage calculations by Slide Rule.

The total vanadium sales by the United States Vanadium Corporation, in the form of ferrovanadium, for 1927 to 1934 inclusive, were 1,862,744 lb. To this must be added 1,071,718 lb. of vanadium oxide for the same period, which at 85% purity and equated to vanadium gives 510,037 lb. of vanadium, making a total of 2,372,781 lb. of vanadium. If this be 25% of the total for the period, then the country consumed 9,491,124 lb., or an average of 1,186,390 lb. per year. Because we may not be justified in saying that we sold about 25% of the United States requirements in any given year, it is not possible to say that Table VII is a scaled picture of the annual consumption, and the conclusions will have to be made on the basis of averages.

TABLE VIII

Sales of Vanadium—Lb.

Year	A — Sales of V to 12 Chief Customers by grades				B	A + B %
	High Speed	Open Hearth	Special	Total	Total of Sales	
1930	—	54,157	32,737	86,894	147,357	59.0
1931	291	82,844	33,974	117,109	158,254	74.5
1932	328	33,878	12,818	47,024	66,747	71.5
1933	768	221,651	32,706	255,125	272,229	68.7
1934	1926	15,872	47,417	200,215	217,631	92.2

Table VIII presents a breakdown of the twelve principal U. S. Vanadium Corporation customers, showing their purchases by grades for the period 1930 to 1934 inclusive. It should be remembered that the specifications and uses of the grades are as follows:

Grade	Uses	Price per Lb.	ANALYSIS				Max. % Si
			Max. % C	% Cr	% Mn	% V	
Open Hearth	Misc. engineering steels, S.A.E. type of steels, etc.	\$2.70	3.00	—	—	35-40	8.00
Special	High speed steels	2.80	1.00	—	—	35-40	4.00
High Speed*	High speed steels	2.90	0.20	—	—	35-40	1.50

* Nearly obsolete.

“Special” has replaced “High Speed” for the requirements of all except one or two customers. Inspection of the records shows that the total number of customers by years is as follows:

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Year	No. of Customers
1930	54
1931	50
1932	45
1933	52
1934	41

It is apparent that no great change has occurred in the number of customers until 1934, when there is a substantial reduction—at least as far as we are concerned; this might or might not be due to a loss of business to a competitor. The quantity of metallic vanadium sold by us in 1934 (217,631 lb.) is lower than the average of the period 1927 to 1934 (233,468 lb.). This may be taken to indicate that nothing toward new applications has developed among the users.

Inspection of Table VIII shows that the twelve principal customers have consumed from 59.0 to 92.2% of our total sales of vanadium in the form of ferrovanadium.

From Table VII it is evident that the preponderant amount of vanadium is sold as "open hearth" grade, that it comprised about 61% of the total sales, and that it is on the ascendancy, while "special" accounted for only about 28% of the sales and it is on the decline.

Taking the cost of V_2O_5 as 40¢ per lb.,¹ and allowing 2 lb. of V_2O_5 to produce 1 lb. of contained vanadium and 46¢ per lb. of vanadium² for the conversion charge, we got a production cost of $80¢ + 46¢ = \$1.26$ per lb. of vanadium. On the basis that our previous costs have been \$1.70 per lb.

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[fol. 264] of vanadium and that we sold at \$2.70 per lb., we could cut the price to \$2.10 per lb. and still make the same *percentage* profit on costs as at the present schedule.

¹ Letter from J. R. Van Fleet to C. E. MacQuigg, p. 53 of Appendix.

² Statement from E. M. Company to C. E. MacQuigg.

(This may be compared with the estimated reduction to \$1.58 per lb. given on page 24 of this report.)

As against our position in the vanadium field, we must consider the position of the Vanadium Corporation of America. The data pertaining to this will be found in Mr. Van Fleet's letter to Mr. Haggerson, dated August 10, 1934, in the Appendix to this report. It is not believed that the conclusions therein which are unfavorable economically to the Vanadium Corporation of America, are to be modified in view of what has been learned since the letter was written.

As an indication of what business might be expected in case we decided to cut the price to such an extent that competition in this country were practically eliminated (or by other means such as agreements) and we sold all of the vanadium, three possible assumptions are presented:

I—We get all of the business in vanadium, but due to the recent trend and in spite of research and development it continues to decline, and therefore in a few years there is little demand for the metal. This assumption is rejected as most unlikely.

II—Business remains the same, but we produce practically all of the vanadium. On the basis of roughly 1,000,000 lb. of vanadium consumed annually, our profit at 84¢ (\$2.10 — \$1.26) would be \$1,141,335 as against a past and present profit of around \$297,199 per year ($\$1.00 \times 297,199$). From the gross profits, we would have to deduct the cost of research and development mentioned later—a total of some \$300,000 over a period of three to five years. Even so, the margin of profit is quite attractive, say, in the neighborhood of \$1,141,335 — \$100,000 = \$1,041,335 for three years, and after that time possibly larger, depending on the demand.

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III—Prices are cut still further so that our profit is only 50¢ per lb. (i.e., vanadium sells at \$1.76). This reduction in price with the results of our research and development programs, so boosts the consump-

tion of vanadium that the sale is increased to 2,000,000 lb. per annum. The net profit is still the same as under Assumption II. Some additional advantages might be obtained, as for example those resulting from a new deoxidizer which might use vanadium in large quantities, and while we might make only 50¢ on the contained vanadium we would make a profit on the other elements. Patent protection on such an alloy would be highly advantageous if the alloy had exceptional merit; it is not fanciful to assume such possibilities.

Several conclusions are possible regarding the course that may be indicated by the facts noted in this report, and these may be summarized as follows:

<i>Possible Action</i>	<i>Favorable Results</i>	<i>Unfavorable Results</i>
I. Take no aggressive action, but continue to let V.C.A. dominate the market and we sell to them—predicated on a continuation of their patronage.	<p>a. We take no risk on ill-will or a possible disturbance of the "status quo" in other fields.</p> <p>b. We will sell the bulk of the vanadium, with no stimulated competition.</p>	<p>a. There is no indication that such a policy will do other than kill all of the disappearing vanadium market, after which there will be no business for anyone.</p> <p>b. If matters are allowed to drift as at present, the vanadium business will continue to disappear and the V.C.A. will in time be defunct or at least moribund, thus forcing them into the hands of the present holders of a substantial portion of their bonded indebtedness, and the</p>

*Possible Action**Favorable Results**Unfavorable Results*

latter interests may be expected to make the most of the situation in the whole alloy field.

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- | | | |
|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <p>II. We sell to V.C.A. but compel them to take an aggressive attitude toward stimulating the waning demand for vanadium.</p> | <p>a. Will avoid friction with the V.C.A., thus minimizing their entry into stronger competition with us in other alloys, e.g., silicon and chromium.</p> <p>b. V.C.A. competition would be most serious in chromium, and it is doubtful if they could menace us without ample supplies of ores. Any mutual agreements would not be jeopardized by this arrangement.</p> <p>c. The V.C.A. will probably be no sharper a competitor than at present and if they are absorbed by A.R.Co., they will most likely get "tough" anyway.</p> | <p>a. This ties our hands and prevents us from obtaining the bulk of the business through research and development.</p> |
| <p>III. We set our own lowered price and by an energetic campaign, we eliminate</p> | <p>a. We can dominate the market and obtain the bulk of the business by virtue of our better eco-</p> | <p>a. We give every cause for retaliation from V.C.A. and one of their large bondhold-</p> |

<i>Possible Action</i>	<i>Favorable Results</i>	<i>Unfavorable Results</i>
V.C.A. from the field.	<p>conomic position and ore supplies.</p> <p>b. We have a free rein to develop new markets and peg the declining use of vanadium.</p> <p>c. We can eliminate V.C.A. as a desirable adjunct to our competitor in other fields.</p>	<p>ers who would seek every opportunity to thwart us in any possible way.</p> <p>b. Competition would be engendered needlessly because of the chance that vanadium as a major steel making element is done for.</p>

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III. NEW POSSIBILITIES FOR EXPANDING THE MARKET IN METALLURGY AND FOR OTHER USES IN TECHNOLOGY. CONCLUSIONS AND RECOMMENDATIONS

1. Research

(a) Active experimentation is under way at Niagara today, looking toward the development of addition agents which will make use of vanadium, and more particularly tie it in with other of our products such as silicon and manganese in such a fashion as to augment the useful effects of all. There is sound metallurgical reasoning back of such researches, and success is confidently looked for.

(b) A process recently acquired by the Corporation concerns the use of vanadium for the penetrative dyeing of leather. By means of this process, the entire thickness of the leather is adequately colored. It applies particularly to the soft leathers used in shoe uppers, although it may possibly be expanded to the heavier grades. This is protected by what we judge to be a broad basic patent application which is prosecuted by us and which should enable us to control the sale of sodium vanadate in very large quantities for the carrying out of this process.

(c) The exploitation of vanadium in cast iron is a possibility which should not be lost sight of and one which we can develop to some extent through work with our own experimental cupola. This development would seem to depend more directly than others on the cost of vanadium. It hardly seems likely that any widespread applications to cast iron metallurgy are possible at the present cost of vanadium.

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2. *Non-Ferrous Metallurgy*

This is not cataloged under the heading of our own research, since it is believed that more rapid advance could be made by our staff working with the development departments of the manufacturers of non-ferrous alloys. When, as, and if the price of vanadium can be substantially reduced, then it would seem reasonable that we may catalyze the investigation of applications to bronzes and other non-ferrous alloys. It should be pointed out that beryllium, at a cost of several dollars per pound, is finding its use in copper alloys on the increase. This field looks attractive, at least.

3. *Vanadium Catalysts*

It is generally believed that vanadium affords the most efficient catalysts for a great number of chemical processes, and that the reason it is not more widely used is partly because of a patent situation, but chiefly because of its cost. The study of vanadium catalyst development was excluded from this report, but any substantial lowering of the selling price would be reflected in increased consumption of "red cake."

4. *Metallic Vanadium*

It is admitted that the properties and possible uses of metallic vanadium are too speculative for the purposes of this report, but it is felt that if an aggressive policy of development is going to be adopted with our production of vanadium, then a research on metallic vanadium is surely

justified. While the specific attributes of the metal in its pure form in a commercial environment can be guessed at only, it is undeniable that ample precedent exists from

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[fol. 269] other metals for saying that such a research is a very attractive gamble. Today the best-informed metallurgist would hesitate to deny the likelihood of unusual and valuable properties being found in, say, an alloy with 13% vanadium and 87% manganese or 87% vanadium and 13% chromium, or any one of many combinations of *pure* metals that might be made under the "rule of 13%." * Vanadium should be capable of production in a substantially pure state if sufficiently useful properties justify its commercial manufacture.

In conclusion, it is evident that from the research angle the Electro Metallurgical Company is in a most favorable position to further exploit vanadium. This is chiefly because of the Laboratory facilities, the experience of the staff trained in alloy steel metallurgy, and the contacts of the Sales-Development Department with the steel makers. Because of these facilities, it would seem that the likelihood of getting the most success from a development program is almost beyond doubt. On the other hand, such a research and development program would have to be carefully planned and energetically followed in all of its ramifications, such as (a) new deoxidizers and their applications in steel, (b) work to apply vanadium in cast iron metallurgy, (c) catalyst developments, (d) cooperative work on vanadium bronzes and light alloy metallurgy, and (e) miscellaneous uses as in the leather tanning industry, ceramics, etc. Such a program would easily require major efforts for three to five years as a minimum, and for the metallurgical research alone would cost from \$50,000 to \$100,000 per year, or a total of \$300,000. The first 1 or 1½ years might be expected to reach the top figure if the program

* Reference is made here to the unique properties that have characterized iron with 13% silicon (Duriron), iron with 13% chromium, iron with 13% manganese (Hadfield's austenitic steel).

[fol. 270] be intensively pursued; the later periods of the work would likely not exceed the smaller amount. The reason for this rather large expenditure to extend the use of an element already established is due to the fact that the users, because of its high cost, have learned to depend on satisfactory substitutes (notably molybdenum) and it would be necessary to overcome the present momentum in the direction away from the use of vanadium. One effective way to swing the tide back toward vanadium would be by showing the great superiority of new combinations.

In spite of some adverse factors, it appears that the hope of success is sufficient to warrant the undertaking of placing a cheapened vanadium in much greater use, and unless totally unforeseen developments occur it does not seem too much to expect the Research Department to practically assure a successful outcome to such a program. However, as soon as the logical price reduction is decided upon but before final decision is made on the steps to be taken, some time should be given the Research and Sales-Development Departments to consider and present a joint program for approval.

Conclusions

1. Unless we are entirely misled by our own figures, we seem to be in the key position in the vanadium business in America, and are therefore in a position to dominate the situation.
2. The metallurgical use of vanadium has been declining for several years and probably will continue to do so because of the present cost to the user.
3. The declining use could be stayed and probably a greatly increased consumption could be built up by research and development work.
4. It is believed that the metallurgical use of vanadium could be revived possibly up to between $\frac{1}{4}$ and $\frac{1}{2}$

[fol. 271] again the magnitude of the present consumption in this country. This would require an in-

tensive program of research and development work which might cost from \$200,000 to \$300,000.

5. The total consumption of vanadium for the country, based on a fair approach to normal business, would be about 1,300,000 lb. per year, and this might be pushed up to a consumption of 1,800,000 lb. per annum, or more. The profits on this business on the present basis of calculation would be between 50 and 75¢ per lb., provided the price schedules suggested are put into effect. The total pounds sold by the U. S. Vanadium Corporation under such circumstances would be an indeterminate matter of competition.

Recommendations

That a decision be made respecting the three possible courses suggested, and in any event an arrangement effected whereby our supplies of vanadium can be successfully exploited.

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IV. APPENDIX. COLLATERAL INFORMATION

In view of their opportunities to obtain current information on both the metallurgical and the commercial angles of the vanadium question, the opinion and advice of Messrs. DuTot, Good, Smith and Crafts have been obtained in personal conferences, and the writer wishes to express his indebtedness to these gentlemen who have assisted him with their counsel. Their collective opinions may be summarized as follows:

Vanadium has at present three more-or-less assured fields of commercial importance. By "assured" is meant that the effects of vanadium are so beneficial as to be axiomatic, and the regard in which it is held is so high that it would take much effort to dislodge it from its position. These applications are:

(a) High Speed Steels

This subject has already been touched upon, and the information received from the conferences with our field staff

merely confirmed what was generally known. Incidentally, it is understood that Mr. Clarage recently told one of our men that their research work had demonstrated the exceptionally high quality of the molybdenum high speed steels (Watertown Arsenal type), and his tip to Electro Metallurgical Company was "to locate some good supplies of molybdenum ores!" The molybdenum high speed steels also use vanadium and have analyses in the following ranges:

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	MoTung	MoMax
Carbon	0.76%	0.78%
Manganese	0.30	—
Silicon	0.30	—
Tungsten	1.60	2.06
Molybdenum	7.90	8.18
Chromium	3.85	5.25
Vanadium	1.10	1.01

(b) High Tensile Forgings and Castings

These have already been referred to, and a class example given as the railroad heavy forgings and castings. American Steel Foundries are using vanadium in their medium-manganese steel castings, and Mr. Hamilton, the Metallurgist, is convinced of the superiority of their analysis.

(c) Small Additions to Sundry Steels

There is a widespread use of vanadium as an addition to quality steels of diverse analyses; this is not large as to tonnage, but is rather general and is the field referred to by Mr. Byrd (page 11). The additions are small so that residual vanadium is not more than 0.03 to 0.05%, but it is generally conceded that these additions represent the compromise between the cost of alloy and beneficiation of the steel through its presence.

With respect to cast iron the outlook that might be obtained from a study of the very meager literature is not justified when it comes to actual shop tests. Mr. E. K. Smith believes that any improvement in the properties of cast iron could be obtained by other addition agents which

we also make and at a much lower cost; e.g., silicon and chromium. The latter two in balanced proportions would, in Mr. Smith's opinion, enhance the quality of cast iron fully as much as would vanadium.

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[fol. 274] It is the writer's belief that the extent to which vanadium usage can be expanded in the cast iron field is dependent chiefly on the amount the price can be lowered. With reductions of substantial nature, say, 35 to 50%, it seems probable that vanadium may take its place *along with* chromium and silicon additions in the production of the so-called high test cast iron.

ELECTRO METALLURGICAL CO.
NEW YORK

Mr. F. H. Haggerson
Room 1714

April 10, 1935

Subject: Survey of Alloy Steels Used
by Automobile Companies

Dear Mr. Haggerson:

This report indicates that molybdenum is making greater inroads on nickel than on chromium. Vanadium is certainly losing out. At our present price, 0.15 to 0.18% vanadium adds \$15.40 per net ton to the mill cost of steel. One per cent. of chromium adds about \$3.00 per ton to mill cost. Molybdenum, 0.15% to 0.25%, adds about \$3.50 per net ton to mill cost.

To make vanadium compete with molybdenum on a cost basis, our price would have to be reduced from the present value, \$2.70 per lb. to about 60¢ per lb. contained.

I plan to bring this up for discussion at our next Research and Development meeting. We may be able to develop a steel with good properties with 1.00% chromium and about 0.10% vanadium. We might be able to create an interest in this if the present price of vanadium were cut in half.

Pardon my marking the report in pencil. Thought it would facilitate comparing the different S.A.E. numbers.

Very truly yours,

WJP-EVL

(signed) W. J. PRIESTLEY

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SURVEY OF ALLOY STEELS USED BY AUTOMOBILE COMPANIES

Approximately 300,000 tons of alloy ingots were consumed in 1934 in the production of 2,778,739 passenger cars and trucks. This year production of automobiles is running about 40% higher, so that the tonnage of alloy steel ingots for this industry should exceed 400,000 tons and ferro-alloy sales for this purpose should be higher than in 1934 but not in the same proportion on account of the change in grades of alloy steel being applied to the various parts of the cars.

In respect to the consumption of ferrochrome in particular, sufficient evidence was obtained to warrant the belief that this alloy will continue in popularity despite the present attitude of the Chrysler Corporation towards carbon-molybdenum steels as the following will show a definite trend in favor of cheaper steels, most of which contain chromium.

Recent advances in the art of steel making have permitted progressive steel makers to control grain size which exerts a powerful influence on machinability, depth hardening, impact resistance and forgeability. Through a combination of grain size control and alloy additions, the properties of the various alloy steels have been noticeably improved to such an extent that nickel, an element frequently used to impart toughness, is not so essential as formerly. Chromium, however, is required for high strength, although molybdenum occupies a definite position in the trade today. Mr. Ferrell of Timken advised me that the addition of a small amount (0.25%) of chromium to Wills' carbon-molybdenum steel would further improve it.

While passenger cars are being constructed of cheaper and better-made steel, truck production follows a reverse trend; i.e., higher percentages of alloying elements for further improvement in strength, along with similar rigid requirements on grain size, are in demand because truck operators exercise no discretion when loading; consequently trucks overloaded 500 to 1000% fail, and criticism of the builder results.

As indicated in my preliminary report, the Chrysler organization is enthusiastic over Mola, a fine-grained abnormal molybdenum-bearing carbon steel, and anyone listening to their account of its marvelous properties without talking to others who may be interested will probably come away with a gloomy opinion of other steels made with nickel, chromium or vanadium. However, it is particularly interesting to us to know that (1) other automobile metallurgists show no enthusiasm, although they are interested; (2) steel companies are not anxious to push this grade; (3) the sales price will have to be increased to permit a profit for the steel company; and (4) Dodge faces a \$100,000 outlay for new heat-treating equipment to handle the steel.

It is also true that the claims made for the properties of Mola steel by Wills and McCleary with respect to surface

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[fol. 276] decarburization, better finish, uniformity, etc., are the result of first, selection of the most suitable heat, and second, special care by all mill operators. Whereas Wills looks upon this steel as ordinary carbon steel plus 0.25% molybdenum, the steel mill operator who made similar steel years ago (see Carnegie Handbook) considers it a very difficult proposition.

(From "The Making, Shaping and Treating of Steel." In the hot working of this steel no benefits that can be attributed to the presence of molybdenum are observed, and many surface defects common in working plain carbon steel may appear in the molybdenum steel, also.)

The Mola steel is made today by treating it in the ladle with upwards of 1½ lb. of aluminum per ton. Such practices are not conducive to the production of clean steel but are

helpful to bloom surfaces and aid in the formation of fine-grained structures.

Mr. McCleary claimed that 1 in. round Mola steel samples quenched and drawn to a tensile strength of 88,000 lb. per sq. in. could be twisted 525° before rupture, while the steel formerly used for rear axles had a maximum twist angle of rupture of 320°. He claimed further that leaf springs of "satisfactory" Mola steel could be bent 135° before failure even though 444 Brinell, while other steel at the same hardness could be broken at 45°.

Republic Steel Corporation metallurgists are pushing chromium and chromium-nickel steels of the \pm 3100 and \pm 5100 type. The Research Department has built a testing device that simulates transmission gear conditions, and they are testing present standard grades of alloy steels to determine, if possible, the most suitable grade of steel for gear units.

Timken developed and are promoting a nickel-molybdenum steel with 0.55 to 0.65% chromium, similar to S.A.E. \pm 4615, for all highly stressed parts, and have considerable confidence in its quality.

Pittsburgh Crucible are devoting particular attention to the production of higher manganese steels containing from 1.00 to 2.50% manganese.

The U. S. Steel Corporation metallurgists favor carbon steel with grain size control, but make and study the production of alloy steels with a view towards furnishing better quality and service than their competitors.

Jones & Laughlin and Great Lakes favor high manganese (1.25 to 2.50% manganese) with and without sulphur for machinability, but make some other grades depending on mill equipment; for instance, Great Lakes have produced large tonnages of chromium steel for Ford leaf springs.

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[fol. 277]

Grades of Steel Used for Important Parts, with Comments

Crankshaft

Ten years ago alloyed steel was used for this important part of the engine; today practically all crankshafts are forged from S.A.E. \pm 1045 (see attached chart of S.A.E.

grades). Ford used a copper chrome-iron steel shaft that serves the purpose satisfactorily.

Carbon	1.25-1.40%
Manganese	0.50-0.60
Silicon	1.90-2.10
Chromium	0.35-0.40
Copper	2.50-2.75
Phosphorus	0.10 max.
Sulphur	0.06 "

Leaf Springs

With the exception of several automobile makers, most leaf springs are made of silico-manganese (S.A.E. ± 9255 or ± 9260) steel. Front springs of trucks have been principally chrome-vanadium (± 6150), but Chevrolet is experimenting with chromium steel (± 5150) on all cars. Ford and Hupp use ± 5150 ; Chrysler is using Mola.

The leaf spring plants, Mather and Standard, prefer ± 5150 to ± 9255 on account of greater uniformity of hardness after heat treatment. Standard Steel Spring report 10 to 15% production of chromium steel during past six months, whereas previous to that time the silico-manganese and carbon steels were the only grades used.

Republic Steel Corporation find less demand for silico-manganese spring steel.

Illinois Steel Company would like to add 0.25 to 0.50% chromium to thick leaf springs of silico-manganese type to obtain better physical properties, but buyers object to any increase in cost.

Coil springs have been made of the same steel as leaf springs depending on the experience of the automobile company.

Connecting Rods

Oldsmobile and LaSalle use ± 1340 , Cadillac ± 4140 , all others use S.A.E. ± 1035 or ± 1040 . The carbon steel is quenched and drawn, the ± 1340 normalized. Any reduction in heat treating costs is very attractive to automobile makers.

Transmission Gears

Principal changes: Chevrolet planning to supplant —50—

[fol. 278] ± 6150 with ± 5150 ; Hudson-Terraplane has substituted ± 4640 for ± 3440 ; Hupmobile changed from ± 5150 to ± 4640 .

Ford continues in the use of chromium and chrome-vanadium; Wandersee has no confidence in nickel-molybdenum steel for this highly important part. Pontiac favors ± 3145 over ± 2345 .

Buses and trucks have been built with carburized transmission gears and as noted above, passenger cars of oil-hardening types. A difference of opinion between these two grades will always exist, the cost of heat treating a 0.40 or 0.45% carbon steel is far less than carburizing a 0.15 or 0.20% carbon nickel-molybdenum steel. The surface hardness of carburized steel will measure 60 Rockwell C, with a core hardness of 30 on ± 4615 or 40 on ± 2512 , but 45 on ± 4615 plus 0.55% chromium. Oil-hardened gears have a surface hardness of 50 to 55 Rockwell C.

Between $3\frac{1}{2}\%$ nickel (± 2300) and $11\frac{1}{2}\%$ nickel-molybdenum (± 4600), the ± 2300 is more difficult to machine than ± 4600 , even though the latter is fine-grained. Higher nickel steels show additional resistance to machining over $3\frac{1}{2}\%$ nickel steels.

Differential Gears

These parts suffer as much abuse in the hands of the average driver as transmission gears, and the selection of steel depends on design with respect to unit pressures and the power plant; however, there is a preference for carburized ring gears with oil-hardened pinions and side gears.

Here we find several changes—mainly, towards nickel-molybdenum. Olds changed from 5% nickel (± 2512) to $11\frac{1}{2}\%$ nickel-molybdenum (± 4615); Hupp from $3\frac{1}{2}\%$ nickel (± 2315) to $11\frac{1}{2}\%$ nickel-molybdenum (± 4615); Nash continues to use oil-hardened ± 2350 and specifies electric furnace steel.

Several companies are beginning to question the advertised claims for electric furnace steel superiority.

Steering Knuckles, Pins, Etc.

Olds, Buick, LaSalle and Cadillac favor the use of 1.60 to 1.90% or 1.35 to 1.65% manganese steels, designing the part a little heavier than if higher strength steels were used.

Ford favors straight chromium steel; Hupp changed from chromium-nickel (± 3100) to chrome-molybdenum (± 4130); Hudson made the same change; Chrysler plans to use Mola.

Camshafts

Wherever possible I believe chromium-bearing chilled cast iron has been used; however, on some automobiles a

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[fol. 279] gear is located in the center of this shaft which prohibits the use of chilled iron. In other cars carburized carbon steel ± 1015 or ± 1020 is used. There is not much difference in cost according to Mr. Smart of Pontiac.

Axle Shafts

- Front I-beam axles are made of carbon steel (± 1040) Chevrolet, nickel-molybdenum (± 3140) Pontiac, high manganese (± 1300) Olds, but Hudson substituted chrome-molybdenum (± 4140) for chromium-nickel (± 3140), while Ford uses chromium steel.

Rear axles are made of ± 3140 , ± 4615 and Mola for Chevrolet, Olds and Chrysler respectively.

International Harvester trucks are using chromium-nickel-molybdenum drive shafts in place of ± 4640 and ± 3140 ; they also are changing from $11\frac{1}{2}\%$ nickel-molybdenum to $3\frac{1}{2}\%$ nickel or 5% nickel steel gears for higher strength.

Wrist-pins

Ford uses a low chromium (Type N) cyanided steel, Olds and Buick a ± 1300 steel with high sulphur, Cadillac and LaSalle a 5% nickel carburized part. Hudson changed from ± 2315 to ± 4615 , Hupp from ± 6115 to X-1315; Chevrolet uses ± 5100 , and Chrysler $3\frac{1}{2}\%$ and 5% nickel.

Exhaust Valves

Practically all these parts contain substantial percentages of chromium to resist the corroding influence of the hot gases. Hupp, for instance, buy their valves from Wilcox who furnish steel containing 14% chromium, 14% nickel and 3% tungsten.

Body Bolts, Studs, Spring Clips, Etc.

Highly stressed bolts are either chromium-nickel, high manganese or nickel-molybdenum depending on local opinion, advice from steel supplier and machinability.

Small Forgings, Etc.

Links in the front and knee action design, spline shafts and other less highly stressed parts are made of practically the same steel and for the same reasons given in the preceding paragraph.

Spicer Manufacturing Company considers Timken's nickel-molybdenum plus 0.55% chromium steel one of the best they have ever used, and use more of this grade than any other for transmission gears, differentials, etc., that are furnished in the assembled condition to passenger car builders.

Much of the above information was obtained only by advising those interviewed that the information would not be

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[fol. 280] published or broadcast. A number of visits proved very interesting and I was pleased at the cordial reception in nearly every instance. I believe this may be credited to the popularity of Electromet alloys.

(signed) R. C. Good

RCG:S

4-5-35

TABLE VIA

Automobile	Present Production per week.	Crankshaft	Front Spring	Rear Spring	Connecting Rod	Transmission Gears	Differential Gears	Steering Parts	Wrist-Pin	Axle Shaft	Cams	Metallurgist
Auburn	200	1045	9260	9260	1035							Thomas
Chevrolet	25000	1045	5150	5150	1035	5150	4815	3130	5150	1040 3140		Mann, E.O.
Pontiac	4000	1045	5150	5150	1035	3145	4815	1300		3140	1020	Smart, C.M.
Olds	4200	1045	9260	9255	1340	3150	4615	1340	x1314	1340 4615		Kethoway, Crawford
Buick	1500	1045	9260	9255	1040	3150	4615A	1340	1115	1300		Schenck, R.B.
LaSalle	500	1045	9255	9255	1340	4620	4620	1340	2512		1015	Danase
Cadillac	200	1045	9255	9255	4140	4620	x4620A	1340	2512		1015	Danase
All Chrysler	20000	1045	M	M	1035	M	M	M	2312 2512	M		McCleary
Reo	550	1045	9255	9255		4615	4615					Coates, J.
Edison	2500	1045	9255	9255	1045	4640	4620	4130	4615	4140		Cannon, J.G.
Packard	400	1045	No change from last year									Graves
Hupp	450	1045	5150	5150	1035	4640	4615	4130	x1315	4630 4140	1020	Watson
Studebaker	1500	1040	9255	9255	1035 4130	4620 5100	4615 4620	4140 4615	4615	1040 4130	1020	Harris, W.J.
Nash	1350	1040	9260	9260		4615	2360	3130	1015	1035	1020	Anglin
Ford	37500	Cast	5150	5150	1040	5115	5115 5150	5130	M	5140		Wandersee, J.
Overland	400	1040	5150	5150	1040	5150	5115 2315	1040 4130	1020	1040 4130	1020	Weir, Sam

International Harvester trucks using CrNiMo steel for drive shafts in place of CrNi formerly; S-1/2 Ni in place of CrNi; CrNi in place of C steel. Caterpillar Tractor changing from elec. to O.H. #2345 for all gears and heavy shafts; links, rollers made of #1045; studs and bolts of #3135 and 10.30.90. Use of Cor-Ten steel growing.

[fol. 281]

IN UNITED STATES DISTRICT COURT

PLAINTIFFS' EXHIBIT NO. 48 FOR IDENTIFICATION

F. P. GORMELY'S OFFICE.

NEW YORK CITY

July 29, 1935

Mr. Blair Burwell,
United States Vanadium Corporation,
Rifle, Colorado.

Vanadium Situation

Mr. C. E. MacQuigg.
Mr. J. M. Price.
Mr. W. J. Priestley.
Mr. J. R. Van Fleet.

Dear Mr. Burwell:

Confirming our talk and Mr. MacQuigg's letter to me of July 22nd, copy to you, in which he confirms his talk with you on Saturday, July 20th, I understand that you have some slants on the Vanadium situation which you think should be added to Mr. MacQuigg's report of July 8th, before we make a definite decision as to what our future policy should be in an attempt to revive the Vanadium business or, at least, hold our present position.

With this in mind and because vacations are on now, I am suggesting that you and Mr. Van Fleet collaborate in a report commenting on Mr. MacQuigg's report and giving any additional ideas you may have which should be incorporated therein or any criticisms you may have as to his findings or suggestions.

We will all get together on this matter about the middle of September to decide on what our policy in the Vanadium situation should be.

Very truly yours,

B. B.

FPGormely/D

[Handwritten notation—sent copy to Mr. Van Fleet]

[fol. 282]

COPY

U. S. Vanadium Corp.

Rifle, Colorado.

September 15, 1935.

Mr. J. R. Van Fleet,
New York City.

VANADIUM REPORT.

Dear Mr. Van Fleet:

Mr. C. E. MacQuigg has well covered the vanadium situation in his report. The field covered is, by necessity, limited to markets and research in connection with the sales of vanadium. His conclusions and suggested policies such as price reductions to stabilize the present market and research development to extend the consumption of vanadium are well supported by his report.

My letter to you is mainly concerned with our position to produce vanadium in the future in such quantities as may be required by fundamental remedies in the situation. We may assume that the vanadium situation is not to remain in the present condition. Either it will decline to a self-sustaining minimum which would deliver the market to the producer able to maintain small production and low cost, or price remedies will shift the business to the low cost producer, or new developments would give us a larger share of an increased industry.

Our ability to produce vanadium in the past has had little relationship to our ability to dispose of our production. The initial market of the Rifle operation was inherited from the Standard Chemical Company, and the Vanadium Corporation has held, from the momentum of its operation in Peru, the largest portion of the market. We know that the high grade ores from Peru are exhausted and the present reserves are in marginal ore requiring a treatment plant at costs approximately equal to the cost of the oxide they are now obtaining from us. It would be expensive for the Vanadium to resume production from Peru and they could not meet price competition and price reductions necessary to stabilize the market. Therefore, it would ap-

pear that our position to sell our future production is materially improved and may be developed in line with our strong position in ores in this country.

From our Rifle operation we still have stocks of vanadium produced at favorable prices. Among our other assets is the successful experience in development of sandstone ores, their treatment and large reserves of ore which are adapted to low cost production. But it must be emphasized that this vanadium is still in the ground in a region remote from transportation, and that the initial production of a new unit for future supply is limited, by engineering reasons, to approximately one-half of the present depressed market.

[fol. 283] No small part of the results of past operations has been due to the continued efforts of a well-developed organization. It resulted in the exploitation of the Rifle deposit in face of the adverse opinion of the Vanadium Corporation as to the economic value of that ore. A point of weakness in our present situation is the fact that only a skeleton exists of that organization and in a new area we must again start to train operators and create a machine for production. The proper time allowance for this build-up is essential and must be considered in any plans for vanadium.

The construction of a single initial unit will consume 56-man shifts for nine months. Three months of the year are unfavorable for construction. At the start we do not have water supply or facilities for 56 men so that the rate of construction must be small in the beginning while this is being provided. In the early months of the year, roads, and especially new roads unpacked by travel, make transportation difficult to and from the railroad. For these reasons we estimate that, in case production will be required in the end of 1936, or early in 1937, then we should start this Fall on water supply and other preliminary work.

Our plans are designed for an initial production of about 600,000 pounds of V_2O_5 yearly. In this unit we will introduce such process improvements as have been developed to the plant stage and obtain a smooth operation and basis

for further expansion if required. The largest element of cost will be in mining and the largest possibility of cost reduction. The nature of the ore deposits makes necessary the development and preparation of a large number of places for mining in advance of production and by the early initiation of exploratory work and diamond drilling in mineral areas we can establish ourselves on a safe basis to supply an increased demand with low costs. A budget for this work is included in our estimated costs. To attempt an enlarged output on short notice would be to seriously handicap our production costs.

I would recommend that we cooperate closely with the Research Department in the development of non-ferrous salts directly from our plant solutions. The possible market in dyes, and in other non-ferrous uses can be materially assisted in its cost side if we can make the required salts simply and easily from the first plant solutions without the cost of precipitation and other steps now used. For example, we have the possibility of making metavanadate of approximately 99.5 purity directly from leach solutions by building up our solution strength and precipitating with ammonium chloride. In red cake we have a lower cost possibility and can continue our present high quality product with much economy. Work should be done on uranium salts, and the production of other byproducts which offer the opportunity of substantial return. I believe that the Research Department can assist us in research in connection with plant improvements looking towards lower costs.

The report by Mr. MacQuigg gives the basis of the market situation and it seems to me that the policy now indicated is largely a question of the timing of essential moves such as are required to maintain the market and to place us in a condition to produce vanadium in the future.

Very truly yours,

/s/ BLAIR BURWELL
Blair Burwell

[fol. 284]

[Handwritten notation—Return—J R van Fleet.]

General Mining Department,

New York City.

September 23, 1935.

Mr. F. H. Haggerson,
Room 1715, Building.

VANADIUM SITUATION

Messrs. F. P. Gormely,
W. H. Sneath,
J. M. Price,
C. E. MacQuigg.

Dear Mr. Haggerson:

On September 1, 1935, we had in stock 1,812,127 pounds V_2O_5 as fused vanadium oxide, and an equivalent of 600,000 pounds V_2O_5 in ferro-vanadium at the various plants, making a total inventory of 2,412,127 pounds V_2O_5 available on that date.

Place	Lbs. V in FeV	Lbs. V_2O_5
Rifle		1,054,958
Columbiana	290,026	97,157
Niagara	14,397	660,012
Welland	10,951	
	<hr/>	<hr/>
	315,374	1,812,127
Equivalent V_2O_5 in FeV		600,000
		<hr/>
Total V_2O_5 lbs.—9/1/35		2,412,127

Vanadium sales for the first eight months of 1935 have amounted to 138,138 lbs. V contained in FeV and 192,814 lbs. V_2O_5 in fused oxide and other products. The Vanadium Corporation of America took 166,073 lbs. of the V_2O_5 in fused oxide and the balance or 26,771 lbs. V_2O_5 was sold as red cake and ammonium metavanadate. Equivalent V_2O_5 up to September 1, 1935 sold is 455,300 lbs.

It is estimated that vanadium sales for the last four months of 1935 will average about 21,000 lbs. V in FeV per month. Also, 84,000 lbs. V_2O_5 will be shipped to the Vanadium Corporation of America, and about 15,000 lbs. V_2O_5 in the other products sold. The equivalent V_2O_5 for the last four months sales is estimated at 258,600 lbs. and the remaining stock of V_2O_5 on hand at the end of the year will be 1,698,227 pounds V_2O_5 at all places and in all products.

Tabulated, the 1935 sales V contained in FeV and V_2O_5 appears as under, with the last four (4) months estimated:

[fol. 285]

1935	Lbs. V in FeV	Lbs. V_2O_5
January	23,558	2,305
February	7,347	1,015
March	15,332	5,915
April	14,985	5,014
May	19,539	6,775
June	16,903	532
July	19,215	87,655
August	21,259	83,603
8 months	138,138	192,814
Last 4 "	84,000	99,000
	222,138	291,814
Equivalent V_2O_5 in FeV		422,086
Total lbs. V_2O_5		713,900

On January 1, 1936 we should have available 2,153,527 lbs. V_2O_5 . It must be remembered that approximately 600,000 lbs. V_2O_5 is always tied up in manufactured ferro-vanadium and that the plant requirements are approximately 500,000 lbs. V_2O_5 yearly, should sales continue about as experienced over the past three years and the usual stocks of FeV maintained. These stocks of finished FeV amount to approximately 300,000 lbs. contained V and is a little over a year's sales' requirements of FeV.

Available Sept. 1, 1935	2,412,127 lbs. V_2O_5
Sales last 4 months 1935	258,600 "
<hr/>	
Available Jan. 1, 1936	2,153,527 "
V_2O_5 in FeV stocks	600,000 "
<hr/>	
	1,553,527 "
Plant requirements 1936	500,000 "
<hr/>	
Available for sales	1,053,527 " "

It may be seen from the above that there is only 1,000,000 lbs. V_2O_5 available for sales until more V_2O_5 is produced. It may also, be seen that with sales maintained at the present level, all of our stocks of V_2O_5 will have been exhausted by the end of 1938, provided no fused oxide is sold. Being so limited in the amount of V_2O_5 available for sales' purposes, we cannot take advantage of attractive business should it be offered. If we accepted 1,000,000 lbs. of fused oxide orders from the Vanadium Corporation of America or from Europe, we would be out of the vanadium business by the end of 1937.

Regardless of the substitution of other metals for vanadium in engineering steels, sales of FeV have remained about the same. It is apparent that the falling off in engineering steels is made up by the general improvement [fol. 286] in the steel business. Sales of V in FeV for the past nine (9) years are listed below, the sales for the last four (4) months of 1935 being estimated:

Year	Lbs. V in FeV	Equiv. lbs. V_2O_5
1927	163,870	311,350
1928	492,500	935,750
1929	345,220	655,920
1930	148,400	281,960
1931	158,710	301,550
1932	70,300	133,570
1933	286,410	544,180
1934	227,600	432,450
1935	222,140	422,100
<hr/>		<hr/>
	2,115,150	4,018,830

It safely may be assumed that the vanadium sales for 1936 will, at least, equal 1935. Records seem to indicate that we enjoy about 30% of the vanadium business, in which case the Vanadium Corporation will require about 1,000,000 lbs. V_2O_5 for their 1936 business. We should sell them vanadic acid at a price low enough so that a source of supply elsewhere will not look attractive. I am quite certain that acid from the Peruvian mine costs more than 80 cents per pound V_2O_5 , but it certainly isn't less than 75 cents.

It may be realized from the above that time is now an important feature of our vanadium situation. It will require a year's time in which to construct the plant in the Paradox Valley and get it into production. If this new plant is to be in production the last of 1936, some of the preparatory work should be started as soon as possible.

The new plant at Uravan—which the Paradox Plant site has been named, and which will be the name of the postoffice to be opened there—is estimated to cost \$366,000. During the Summer and Fall of 1934 the salt works—which is to be a part of any operation in the Paradox, was installed, and the power canal was cleaned out and repaired, with an expenditure of approximately \$16,000.

There is yet considerable preliminary work which can be done to advantage before the actual construction of the plant shall commence. During the Winter and Spring the weather is often bad in this section and would interfere with and make outside construction more costly. The work that can be done this Fall to advantage, would consist of repairing the buildings on the plant site for the housing of construction forces, putting in the water supply, finishing the re-instatement of the power plant, and moving from Rifle compressors and other equipment necessary for construction purposes. Also, there is a certain amount of [fol. 287] underground work in the mine which can be done to advantage with a small crew, preparatory to mining the ore bodies which have already been developed. The design for the construction of the plant calls for underground ore bins. The location for the plant is such that these underground ore bins can be made much larger and cheaper than bins constructed from timber or steel.

It is recommended that we proceed with this preparatory work this Fall and Winter with an expenditure not to exceed \$5,000 per month. There will be no additional overhead on this work, as we have the overhead anyway. With this work completed we will then be all ready for actual construction in the early Spring of 1936, and can have the first unit in operation by the end of 1936.

A single roaster plant on the Paradox ore will produce from 600,000 to 750,000 pounds of V_2O_5 yearly, which will take care of our own needs and accumulate some excess. This capacity can rapidly be increased by the addition of roaster units. The plant has been designed to allow for expansion in case increased capacity is necessary.

In Mr. MacQuigg's research report of June 1935, his conclusion points out that it would, probably, be advisable to reduce the price of vanadium products to the trade. With the new plant in operation in the Paradox Valley the price can be considerably reduced and still make as much profit as we made on the Rifle production.

We took over the United States Vanadium Company on January 1, 1927, paying therefore in cash and securities a total value of \$2,275,000. In 1927 the Rifle property was set up on the books of the United States Vanadium Corporation as follows:

Real Estate & Equipment	—	\$ 528,202.89
Mine	—	1,539,395.31
Discovered Mine	—	924,480.00
		<hr/>
Total Property Set-Up	—	\$2,992,078.20

This entire set-up was depreciated and depleted with the exception of \$25,000 on the production at Rifle, amounting to approximately, 7,000,000 pounds V_2O_5 . The \$25,000 consists of \$21,000 real estate and equipment at Columbiana, and \$4,000 real estate at Rifle. This write-off amounted to 42¢ per pound on the production at Rifle; the average production costs at Rifle Plant were 38¢ per pound. The write-off on the Rifle production was not uniform over the

years, and varied considerably, but the average cost of the V_2O_5 in ferro-vanadium was from 80¢ to 85¢ per pound.

[fol. 288] The net profits, after all charges, on the Rifle operation to January 1, 1935, on approximately 4,600,000 pounds of V_2O_5 sold, amounted to \$1,965,375.68 or approximately, 42¢ per pound of V_2O_5 sold.

The present book value of all the property of the U. S. Vanadium Corporation is \$369,719.62. As stated above, approximately, \$25,000 of this amount is in real estate at Columbiana and Rifle. The balance of \$344,719.62 represents the value of the Paradox Valley property. With an additional expenditure of \$350,000 for the new Plant, the total investment in the Paradox Valley will amount to, approximately, \$695,000.

We own large vanadium resources in the Paradox Valley. There is measured and mined out on dumps on our property, a total of 148,170 tons of ore containing 5,300,000 pounds of recoverable V_2O_5 . In addition, we have partly developed by underground workings and core drilling, 225,000 tons containing 8,100,000 pounds recoverable V_2O_5 , making a total of developed resources amounting to 13,400,000 pounds of recoverable V_2O_5 . In addition to this there is a prospective ore tonnage which can, reasonably, be estimated at a minimum of 10,000,000 pounds recoverable V_2O_5 ; and the prospects in this section would indicate a plentiful supply of vanadium for many years to come.

If we should depreciate and deplete the Paradox investment of \$695,000 on the recoverable V_2O_5 already developed—amounting to 13,400,000 pounds—these charges would amount to only 5.2¢ per pound of V_2O_5 recovered, against the 42¢ necessary at Rifle. Estimates of the production costs in the Paradox indicate an ultimate low-cost operation. This cost has been placed at 40¢ per pound including the depreciation and depletion charges. From the Paradox operation we will, also, recover uranium and radium compounds which, if credited to the production of V_2O_5 , would somewhat lower the estimated cost of 40¢ per pound.

If we allow the same profit of 42¢ per pound of V_2O_5 sold, as experienced in the sales up to January 1, 1935, we can reduce the price of V in ferro-vanadium to \$2.10 and still have the same profit.

	1 lb. V_2O_5
Estimated Cost Paradox	\$0.40
Profit	.42
	<hr/>
	\$0.82
2 lbs. for each lb. V in FeV	1.64
Conversion Cost	.46
	<hr/>
Total	\$2.10

[fol. 289] Realizing 25¢ per pound profit on V_2O_5 which would amount to 50¢ per pound of V in FeV, the sales price could be as low as \$1.76 per pound of V in FeV.

The policy of reducing prices must be carefully considered and it may be pointed out that as long as we supply V_2O_5 to the Vanadium Corporation of America, we cannot reduce the price without making some adjustment with them on the high-priced material they have purchased from us and are holding in inventory. Under the circumstances a reduction in price could not very well be made immediately.

Mr. MacQuigg's report also indicates that the consumption of vanadium could be considerably increased by developing new uses in research. He estimates that this research would require from 3 to 5 years at a cost of, approximately, \$300,000. There is no question in my mind but what research on new uses for vanadium, and research to stimulate the present uses for vanadium, is very important and essential to the future of the business.

A certain amount of this research should be done in connection with the plant operation in making V_2O_5 . Mr. Barwell has pointed out that the research of the non-ferrous uses can be materially assisted in its cost side, if we can make the required salts simply and easily from the first plant solutions, rendering the precipitation and other steps now used, unnecessary.

It may be pointed out, however, that there will be no necessity for research along any lines, unless we are in position to take advantage of it on the production side. Unless we prepare for renewed production of V_2O_5 we will be out of the vanadium business within three years.

Very truly yours,

EW/J.R. Van Fleet
IC
Enc.

[fol. 290]

General Mining Department,

New York City.

September 23, 1935.

Mr. F. H. Haggerson,
Room 1715, Building.

VANADIUM SITUATION.

Messrs. F. P. Gormely,
W. H. Sneath,
J. M. Price,
C. E. MacQuigg

Dear Mr. Haggerson:

On September 1, 1935, we had in stock 1,812,127 pounds V_2O_5 as fused vanadium oxide, and an equivalent of 600,000 pounds V_2O_5 in ferro-vanadium at the various plants, making a total inventory of 2,412,127 pounds V_2O_5 available on that date.

Place	Lbs. V in FeV	Lbs. V_2O_5
Rifle		1,054,958
Columbiana	290,026	97,157
Niagara	14,397	660,012
Welland	10,951	
	<hr/> 315,374	<hr/> 1,812,127
Equivalent V_2O_5 in FeV		600,000
		<hr/>
Total V_2O_5 lbs.—9/1/35		2,412,127

Vanadium sales for the first eight months of 1935 have amounted to 138,138 lbs. V contained in FeV and 192,814 lbs. V2O5 in fused oxide and other products. The Vanadium Corporation of America took 166,073 lbs. of the V2O5 in fused oxide and the balance or 26,771 lbs. V2O5 was sold as red cake and ammonium metavanadate. Equivalent V2O5 up to September 1, 1935 sold is 455,300 lbs.

It is estimated that vanadium sales for the last four months of 1935 will average about 21,000 lbs. V in FeV per month. Also, 84,000 lbs. V2O5 will be shipped to the Vanadium Corporation of America, and about 15,000 lbs. V2O5 in the other products sold. The equivalent V2O5 for the last four months sales is estimated at 258,600 lbs. and the remaining stock of V2O5 on hand at the end of the year will be 1,698,227 pounds V2O5 at all places and in all products.

Tabulated, the 1935 sales V contained in FeV and V2O5 appears as under, with the last four (4) months estimated:

[fol. 291]

1935	Lbs. V in FeV	Lbs. V2O5
January	23,558	2,305
February	7,347	1,015
March	15,332	5,915
April	14,985	5,014
May	19,539	6,775
June	16,903	532
July	19,215	87,655
August	21,259	83,603
8 months	138,138	192,814
Last 4 "	84,000	99,000
	222,138	291,814
Equivalent V2O5 in FeV		422,086
Total lbs. V2O5		713,900

On January 1, 1936 we should have available 2,153,527 lbs. V2O5. It must be remembered that approximately

600,000 lbs. V2O5 is always tied up in manufactured ferro-vanadium and that the plant requirements are approximately, 500,000 lbs. V2O5 yearly, should sales continue about as experienced over the past three years and the usual stocks of FeV maintained. These stocks of finished FeV amount to approximately, 300,000 lbs. contained V and is a little over a year's sales' requirements of FeV.

Available Sept. 1, 1935	2,412,127 lbs. V2O5
Sales last 4 months 1935	258,600 "
<hr/>	
Available Jan. 1, 1936	2,153,527 "
V2O5 in FeV stocks	600,000 "
<hr/>	
	1,553,527 "
Plant requirements 1936	500,000 "
<hr/>	
Available for sales	1,053,527 "

It may be seen from the above that there is only 1,000,000 lbs. V2O5 available for sales until more V2O5 is produced. It may also, be seen that with sales maintained at the present level, all of our stocks of V2O5 will have been exhausted by the end of 1938, provided no fused oxide is sold. Being so limited in the amount of V2O5 available for sales' purposes, we cannot take advantage of attractive business should it be offered. If we accepted 1,000,000 lbs. of fused oxide orders from the Vanadium Corporation of America or from Europe, we would be out of the vanadium business by the end of 1937.

Regardless of the substitution of other metals for vanadium in engineering steels, sales of FeV have remained about the same. It is apparent that the falling off in engineering steels is made up by the general improvement [fol. 292] in the steel business. Sales of V in FeV for the past nine (9) years are listed below, the sales for the last four (4) months of 1935 being estimated:

Year	Lbs. V in FeV	Equiv. lbs. V2O5
1927	163,870	311,350
1928	492,500	935,750
1929	345,220	655,920
1930	148,400	281,960
1931	158,710	301,550
1932	70,300	133,570
1933	286,410	544,180
1934	227,600	432,450
1935	222,140	422,100
	<hr/> 2,115,150	<hr/> 4,018,830

It safely may be assumed that the vanadium sales for 1936 will, at least, equal 1935. Records seem to indicate that we enjoy about 30% of the vanadium business, in which case the Vanadium Corporation will require about 1,000,000 lbs. V2O5 for their 1936 business. We should sell them vanadic acid at a price low enough so that a source of supply elsewhere will not look attractive. I am quite certain that acid from the Peruvian mine costs more than 80 cents per pound V2O5, but it certainly isn't less than 75 cents.

It may be realized from the above that time is now an important feature of our vanadium situation. It will require a year's time in which to construct the plant in the Paradox Valley and get it into production. If this new plant is to be in production the last of 1936, some of the preparatory work should be started as soon as possible.

The new plant at Uravan—which the Paradox Plant site has been named, and which will be the name of the post-office to be opened there—is estimated to cost \$366,000. During the Summer and Fall of 1934 the salt works—which is to be a part of any operation in the Paradox, was installed, and the power canal was cleaned out and repaired, with an expenditure of approximately \$16,000.

There is yet considerable preliminary work which can be done to advantage before the actual construction of the plant shall commence. During the Winter and Spring the weather is often bad in this section and would interfere

with and make outside construction more costly. The work that can be done this Fall to advantage, would consist of repairing the buildings on the plant site for the housing of construction forces, putting in the water supply, finishing the re-instatement of the power plant, and moving from Rifle compressors and other equipment necessary for construction purposes. Also, there is a certain amount of [fol. 293] underground work in the mine which can be done to advantage with a small crew, preparatory to mining the ore bodies which have already been developed. The design for the construction of the plant calls for underground ore bins. The location for the plant is such that these underground ore bins can be made much larger and cheaper than bins constructed from timber or steel.

It is recommended that we proceed with this preparatory work this Fall and Winter with an expenditure not to exceed \$5,000 per month. There will be no additional overhead on this work, as we have the overhead anyway. With this work completed we will then be all ready for actual construction in the early Spring of 1936, and can have the first unit in operation by the end of 1936.

A single roaster plant on the Paradox ore will produce from 600,000 to 750,000 pounds of V₂O₅ yearly, which will take care of our own needs and accumulate some excess. This capacity can rapidly be increased by the addition of roaster units. The plant has been designed to allow for expansion in case increased capacity is necessary.

In Mr. MacQuigg's research report of June 1935, his conclusion points out that it would, probably, be advisable to reduce the price of vanadium products to the trade. With the new plant in operation in the Paradox Valley the price can be considerably reduced and still make as much profit as we made on the Rifle production.

We took over the United States Vanadium Company on January 1, 1927, paying therefore in cash and securities a total value of \$2,275,000. In 1927 the Rifle property was set up on the books of the United States Vanadium Corporation as follows:

Real Estate & Equipment	—	\$ 528,202.89
Mine	—	1,539,395.31
Discovered Mine	—	924,480.00
Total Property Set-Up	—	\$2,992,078.20

This entire set-up was depreciated and depleted with the exception of \$25,000 on the production at Rifle, amounting to approximately, 7,000,000 pounds V2O5. The \$25,000 consists of \$21,000 real estate and equipment at Columbiana, and \$4,000 real estate at Rifle. This write-off amounted to 42¢ per pound on the production at Rifle; the average production costs at Rifle Plant were 38¢ per pound. The write-off on the Rifle production was not uniform over the years, and varied considerably, but the average cost of the V2O5 in ferro-vanadium was from 80¢ to 85¢ per pound.

[fol. 294] The net profits, after all charges, on the Rifle operation to January 1, 1935, on approximately 4,600,000 pounds of V2O5 sold, amounted to \$1,965,375.68 or approximately, 42¢ per pound of V2O5 sold.

The present book value of all the property of the U. S. Vanadium Corporation is \$369,719.62. As stated above, approximately, \$25,000 of this amount is in real estate at Columbiana and Rifle. The balance of \$344,719.62 represents the value of the Paradox Valley property. With an additional expenditure of \$350,000 for the new Plant, the total investment in the Paradox Valley will amount to, approximately, \$695,000.

We own large vanadium resources in the Paradox Valley. There is measured and mined out on dumps on our property, a total of 148,170 tons of ore containing 5,300,000 pounds of recoverable V2O5. In addition, we have partly developed by underground workings and core drilling, 225,000 tons containing 8,100,000 pounds recoverable V2O5, making a total of developed resources amounting to 13,400,000 pounds of recoverable V2O5. In addition to this there is a prospective ore tonnage which can, reasonably, be estimated at a minimum of 10,000,000 pounds recoverable V2O5; and the prospects in this section would

indicate a plentiful supply of vanadium for many years to come.

If we should depreciate and deplete the Paradox investment of \$695,000 on the recoverable V2O5 already developed—amounting to 13,400,000 pounds—these charges would amount to only 5.2¢ per pound of V2O5 recovered, against the 42¢ necessary at Rifle. Estimates of the production costs in the Paradox indicate an ultimate low-cost operation. This cost has been placed at 40¢ per pound including the depreciation and depletion charges. From the Paradox operation we will, also, recover uranium and radium compounds which, if credited to the production of V2O5, would somewhat lower the estimated cost of 40¢ per pound.

If we allow the same profit of 42¢ per pound of V2O5 sold, as experienced in the sales up to January 1, 1935, we can reduce the price of V in ferro-vanadium to \$2.10 and still have the same profit.

	Lb. V2O5
Estimated Cost Paradox	\$0.40
Profit	.42
	<hr/>
	\$0.82
2 lbs. for each lb.	
V in FeV	1.64
Conversion Cost	.46
	<hr/>
Total	\$2.10

[fol. 295] Realizing 25¢ per pound profit on V2O5 which would amount to 50¢ per pound of V in FeV, the sales price could be as low as \$1.76 per pound of V in FeV.

The policy of reducing prices must be carefully considered and it may be pointed out that as long as we supply V2O5 to the Vanadium Corporation of America, we cannot reduce the price without making some adjustment with them on the high-priced material they have purchased from us and are holding in inventory. Under the circumstances a reduction in price could not very well be made immediately.

Mr. MacQuigg's report also indicates that the consumption of vanadium could be considerably increased by developing new uses in research. He estimates that this research would require from 3 to 5 years at a cost of, approximately, \$300,000. There is no question in my mind but what research on new uses for vanadium, and research to stimulate the present uses for vanadium, is very important and essential to the future of the business.

A certain amount of this research should be done in connection with the plant operation in making V2O5. Mr. Burwell has pointed out that the research of the non-ferrous uses can be materially assisted in its cost side, if we can make the required salts simply and easily from the first plant solutions, rendering the precipitation and other steps now used, unnecessary.

It may be pointed out, however, that there will be no necessity for research along any lines, unless we are in position to take advantage of it on the production side. Unless we prepare for renewed production of V2O5 we will be out of the vanadium business within three years.

Very truly yours,

EW/J. R. Van Fleet

IC

Enc.

[fol. 296]

COPY

General Mining Department,

New York City.

September 26, 1935.

VANADIUM SITUATION.

Mr. F. P. Gormely,
Room 1715, Building.

Messrs. F. H. Haggerson,
W. H. Sneath,
J. M. Price,
C. E. MacQuigg.

Dear Mr. Gormely:

Sales of vanadium contained in ferro-vanadium, and vanadium oxide in other products, have depleted our stocks of fused vanadium oxide so that we now have available, approximately, 1,000,000 pounds to satisfy vanadium oxide sales until we are in production with a plant in the Paradox Valley.

We will have on January 1, 1936, 2,153,527 pounds of V_2O_5 , in all forms and at all localities. Of this amount 600,000 pounds of V_2O_5 will be converted into V in our stocks of FeV. During 1936, 500,000 pounds V_2O_5 will be necessary for plant requirements in keeping the stock of V in FeV up to about a year's sales requirements:

Available Jan. 1, 1936	2,153,527 lbs. V_2O_5	
V_2O_5 in FeV stocks	600,000	"
	<hr/>	
	1,553,527	"
Plant requirements 1936	500,000	"
	<hr/>	
Available for sales	1,053,527	"

Should we continue to supply the Vanadium Corporation of America with V_2O_5 , or take advantage of any other attractive business which might be offered, this entire stock

could easily be disposed of during 1936. If this were the case, by the end of 1936 we would have *no* available V_2O_5 for sale, and all of our vanadium would be contained in approximately, a year's supply of V contained in manufactured FeV for sales requirements.

It must be realized that *time* is now an important feature of our vanadium situation. It will require a year in which to construct a plant in the Paradox Valley and get it into production.

The new Paradox Plant, completed, is estimated to cost \$366,000. Of this amount, approximately, \$16,000 has been expended repairing the power dam and canal, and installing the salt works.

[fol. 297] There is considerable work which should be done in preparation for the actual construction of the Plant. This work would consist of repairing existing buildings and otherwise providing housing facilities for a construction crew; installing the water system which must be piped a distance of two (2) miles; finishing the reinstatement of the power plant; moving and installing necessary equipment from Rifle. There is a certain amount of underground work in the mine which can be done to advantage with a small crew, preparatory to mining the ore bodies which have already been developed. The design for the construction of the Plant calls for underground ore bins and all of this work, together with excavations for foundations can be put in readiness for actual construction of the Plant during the Summer and Fall of 1936.

Should it seem desirable not to begin the actual construction next year, there will be little or no deterioration, or upkeep, of this preparatory work. It is recommended that this preparatory work be done during the Fall and Winter with expenditures not to exceed \$5,000 monthly.

From my letter to Mr. Haggerson, dated September 23, 1935, it may be seen that we will be able to produce V_2O_5 in the Paradox Valley for 40¢ per lb. including depletion and depreciation, and that we could sell V in ferro-vanadium for \$2.10 per pound and *make the same profit* per pound

of V_2O_5 , 42¢ which we have made in the 4,600,000 lbs. of V_2O_5 sold to January 1, 1935.

It is pointed out that all of the production from Rifle had to take a depreciation and depletion charge of 42¢ per pound in order to completely write off the entire investment at Rifle, with the exception of \$4,000 real estate valuation. In the Paradox Valley the entire investment will be the purchase price of the property and the cost of the new plant, making a total of \$695,000.

The V_2O_5 in ore reserves in the Paradox, already partially and fully developed, amount to 13,400,000 pounds. Prospective additional resources estimated to be 10,000,000 pounds as a minimum. If the entire Paradox investment is depleted and depreciated on 13,400,000 pounds of developed V_2O_5 , this charge will amount to only 5.2¢ per pound of V_2O_5 recovered against the 42¢ necessary at Rifle.

By allowing a profit of 25¢ per pound on V_2O_5 , which would amount to 50¢ per pound of V in FeV, the sales price could be as low as \$1.76 per pound of V in FeV.

Very truly yours,

EW/J.R. Van Fleet
IC

[fol. 298]

COPY

General Mining Department,

New York City

September 26, 1935.

VANADIUM SITUATION.

Mr. F. P. Gormely
Room 1715, Building

Messrs. F. H. Haggerson
W. H. Sneath
J. M. Price
C. E. MacQuigg

Dear Mr. Gormely:

Sales of vanadium contained in ferro-vanadium, and vanadium oxide in other products, have depleted our stocks of fused vanadium oxide so that we now have available, approximately, 1,000,000 pounds to satisfy vanadium oxide sales until we are in production with a plant in the Paradox Valley.

We will have on January 1, 1936, 2,153,527 pounds of V₂O₅, in all forms and at all localities. Of this amount 600,000 pounds of V₂O₅ will be converted into V in our stocks of FeV. During 1936, 500,000 pounds V₂O₅ will be necessary for plant requirements in keeping the stock of V in FeV up to about a year's sales requirements:

Available Jan. 1, 1936	2,153,527 lbs.	V ₂ O ₅
V ₂ O ₅ in FeV stocks	600,000	"
	<hr/>	
	1,553,527	"
Plant requirements 1936	500,000	"
	<hr/>	
Available for sales	1,053,527	"

Should we continue to supply the Vanadium Corporation of America with V₂O₅, or take advantage of any other attractive business which might be offered, this entire stock

could easily be disposed of during 1936. If this were the case, by the end of 1936 we would have *no* available V205 for sale, and all of our vanadium would be contained in approximately, a year's supply of V contained in manufactured FeV for sales requirements.

It must be realized that *time* is now an important feature of our vanadium situation. It will require a year in which to construct a plant in the Paradox Valley and get it into production.

The new Paradox Plant, completed, is estimated to cost \$366,000. Of this amount, approximately \$16,000 has been expended repairing the power dam and canal, and installing the salt works.

[fol. 299] There is considerable work which should be done in preparation for the actual construction of the Plant. This work would consist of repairing existing buildings and otherwise providing housing facilities for a construction crew; installing the water system which must be piped a distance of two (2) miles; finishing the reinstatement of the power plant; moving and installing necessary equipment from Rifle. There is a certain amount of underground work in the mine which can be done to advantage with a small crew, preparatory to mining the ore bodies which have already been developed. The design for the construction of the Plant calls for underground ore bins and all of this work, together with excavations for foundations can be put in readiness for actual construction of the Plant during the Summer and Fall of 1936.

Should it seem desirable not to begin the actual construction next year, there will be little or no deterioration, or upkeep of this preparatory work. It is recommended that this preparatory work be done during the Fall and Winter with expenditures not to exceed \$5,000 monthly.

From my letter to Mr. Haggerson, dated September 23, 1935, it may be seen that we will be able to produce V205 in the Paradox Valley for 40¢ per lb. including depletion and depreciation, and that we could sell V in Ferrovanadium for \$2.10 per pound and *make the same profit* per

pound of V2O5, 42¢ which we have made on the 4,600,000 lbs. of V2O5 sold to January 1, 1935.

It is pointed out that all of the production from Rifle had to take a depreciation and depletion charge of 42¢ per pound in order to completely write off the entire investment at Rifle, with the exception of \$4,000 real estate valuation. In the Paradox Valley the entire investment will be the purchase price of the property and the cost of the new plant, making a total of \$695,000.

The V2O5 in ore reserves in the Paradox, already partially and fully developed, amount to 13,400,000 pounds. Prospective additional resources estimated to be 10,000,000 pounds as a minimum. If the entire Paradox investment is depleted and depreciated on 13,400,000 pounds of developed V2O5, this charge will amount to only 5.2¢ per pound of V2O5 recovered against the 42¢ necessary at Rifle.

By allowing a profit of 25¢ per pound on V2O5, which would amount to 50¢ per pound of V in FeV, the sales price could be as low as \$1.76 per pound of V in FeV.

Very truly yours,

EW/J.R. Van Fleet
IC

[fol. 300]

[Handwritten notation: Mr. Van Fleet]

U. S. Vanadium Corp.

New York City.

Mr. F. H. Haggerson,
Room 1715, Building.

December 3, 1935.

Messrs. F. P. Gormely,
W. H. Sneath,
J. M. Price.

VANADIUM SITUATION.

Dear Mr. Haggerson:

There has been much discussion of late concerning a reduction in the sales' price of vanadium. It is now thought that a reduction in price will greatly stimulate the use of vanadium. The attached chart attempts to show in graphic form the profits per pound of V_2O_5 at various costs of production with the various proposed reduced sales' prices.

The top black line in the chart shows the sales' price obtained for V_2O_5 when V in FeV is selling at the different prices. The center black line shows the sales' price of V_2O_5 as fused vanadium oxide as sold to the Vanadium Corporation of America. The bottom black line represents the cost of manufacturing V_2O_5 as fused vanadium oxide.

It may be seen, therefore, directly from the chart that the profit in selling fused vanadium oxide to the Vanadium Corporation of America at 80¢ per pound, is 20¢ per pound, and that the profit per pound of V_2O_5 when selling V in FeV for \$2.70 per pound is approximately, 50¢.

Our present stock of fused vanadium oxide is held on the books at 60¢ per pound. This book cost, probably, does not represent the true cost as there have been many write-ups and write-downs on our present stock of V_2O_5 ; and this 60¢ merely represents the actual cost of production plus the remaining write-off as of December 31, 1934 to clean up the Rifle investment.

The production costs at the new plant in Paradox Valley will be considerably lower. Whereas there was a large investment to write off at Rifle on a comparatively small amount of product, in the Paradox Valley the entire investment including new plant and property, will be approximately \$700,000 and the write-off only about five cents (5¢) per pound.

Should we have a plant in operation the latter part of 1936 it is estimated that our production costs in the Paradox Valley will reach 40¢ per pound by the middle of 1937, and that the ultimate cost in the Paradox Valley will not be over 35¢ per pound. By assuming credits for some sales of uranium oxide which will be produced from the [fol. 301] Paradox ores, the ultimate actual cost of V_2O_5 will, probably, be even lower than 35¢ per pound.

It may be seen by the chart that should the price of V in FeV be reduced to \$2.30 per pound with the cost of V_2O_5 at 60¢ per pound, the profit per pound of V_2O_5 is 30¢. Should the price of V in FeV be reduced to \$2.30 per pound, a reduction in the sales price of V_2O_5 to the Vanadium Corporation of America is indicated.

When reducing V_2O_5 to V in FeV it requires two (2) pounds of V_2O_5 to make one (1) pound of V in FeV. If the price of V in FeV is reduced to \$2.30 per pound or a reduction of 40¢ per pound, the reduction then in profits on V_2O_5 put into the FeV is 20¢ per pound. The idea in reducing the price of V in FeV is to stimulate and encourage the use of vanadium in alloy steels, and the Vanadium Corporation of America will, undoubtedly, share proportionately in this increase in sales. It is, therefore, reasonable that they should share one-half the loss in profits per pound of V_2O_5 in this attempt at stimulation, and accordingly the sales price of V_2O_5 to the Vanadium Corporation of America would be a reduction of 10¢ from their present price, or 70¢ per pound.

The chart shows that a further reduction to \$2.00 per pound of V in FeV later on, would call for a sales price of 65¢ per pound V_2O_5 to the Vanadium Corporation of

America. Should this further reduction be made in the sales price of V in FeV, our ultimate profit per pound of V_2O_5 will be 40¢ and the profit per pound of V_2O_5 sold to the Vanadium Corporation of America will be 30¢ per pound.

The blue, broken line at the bottom of the chart represents the profits in dollars on sales of V in FeV under the profits shown on the chart. The estimated sales of V in FeV each year to establish this blue line are also shown on the chart as follows:

Estimated Sales V in FeV.

1935	220,000 pounds
1936	300,000 "
1937	400,000 "
1938	500,000 "

It may be seen from the chart that on account of the reduction of price that in 1936 the profit will be less than in 1935 on sales of V in FeV, but it is estimated that by 1937 we will begin to reap the benefit of price reductions, and that the sales will considerably increase, and by 1938 they should reach 500,000 pounds.

[fol. 302] The red line next above represents the total profits on vanadium sales, including the profit on the V_2O_5 sold to the Vanadium Corporation of America. It will, also, be noted on this line that the total profits of vanadium sales of all kinds, will be slightly less in 1936 due to reductions and high cost of V_2O_5 , but that by 1937 the profits are better, and by 1938 exceed any profits yet made on vanadium sales.

The estimated sales of fused vanadium oxide are shown on the chart as follows:

Estimated Sales of V_2O_5 .

1935	375,000 pounds
1936	500,000 "
1937	1,000,000 "
1938	1,000,000 "

It may be thought that the Vanadium Corporation would require more than 1,000,000 pounds V_2O_5 during 1938 if the estimated stimulation in sales is brought about, but in estimating 500,000 pounds of V in FeV for 1938, I am assuming that we will obtain a larger proportion of the vanadium sales than we have previously enjoyed.

No attempt to show profits in sales of V_2O_5 for direct smelting have been made, as it is assumed that such sales will detract from the sales of V in FeV. However, it is quite likely that the sales' price of V_2O_5 for direct smelting purposes would be, approximately, \$1.00 per pound on which a correspondingly larger profit would be estimated—65¢ per pound against 40¢ per pound—the profit estimated on sales of V in FeV for 1938 on this chart.

We now have available for sales as fused vanadium oxide a little less than 900,000 pounds V_2O_5 when deducting the 80,000# sold to the Vanadium Corporation of America last week. This quantity of V_2O_5 available for sales is arrived at after reserving sufficient material for Columbian operations during 1936 at the end of which time (1936) we will have in stock, approximately, 300,000 pounds of V in FeV. Although I have estimated, on the chart, only 500,000 pounds of V_2O_5 as sales to the Vanadium Corporation of America for 1936, it is quite likely that they might require more than this if the vanadium business continues to brighten.

It may be realized, therefore, that before the end of 1936 it will be absolutely necessary to be producing more fused vanadium oxide.

Very truly yours,

EW/J. R. Van Fleet
IC
Enc.